THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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BRITISH TRADE WEAKNESSES IN AUSTRALIA.

IT is a very interesting occupation to watch this now continuous stream of British trade-seekers and students of commerce as they pack their trunks with guide books, business literature, letters of introduction, and the inevitable paraphernalia of a tour abroad. Their outgoing, with its open mind and its bright expectation, is encouraging to witness, and the REVIEW always wishes them success as heartily as men ever gave a send-off to comrades destined for a foreign battlefield. But their return! That is deserving of the closer study. They have had time for full reflection on the homeward voyage, and set foot again on English soil wiser men than when they left it. Sometimes, if they be national representatives, as in the case of a Prince of the Royal house, their message gains great publicity, and every man wonders how far the advice to "wake-up" has appropriateness to himself. Some take the advice in the spirit in which it is intended, and strengthen every conceivable weak place in the armour, taking pains that their trade scouts are well qualified and are situated at the most likely spots. Others yawningly mumble, "You have waked me too soon. I must slumber again." In the ordinary course of events slumberers would learn from the greater success of their rivals, and would, though late in the day, see the folly of their ways at last and rise to new efforts handicapped more than they need have been in competing with the foreigner, or else they would pass out of existence altogether, crowded out by the keenness of competition.

If in times of prosperity we may have become lethargic, it has been well for us when we have acted spiritedly under well meant and disinterested advice. We do not think that we suffered very seriously in foreign reputation when the Prince sounded his note as the outcome of his studies. His impressions must have been well marked, or he would never have felt it to be his duty to so speak, and the fruit from an awakening was no doubt thought by him to far outweigh any prejudicial effect that might occur through allowing buyers abroad to gain the impression that we were all asleep. As a matter of fact, it was because competing countries were already profiting from our inattention and lethargy that the utterance of the message was regarded as an imperative duty. But we have had other warnings besides that against slumber. There is a sleep from which one awakens like a giant refreshed, and the British trader has sometimes come by his own again after a stern encounter. If the charge of lethargy had been the only one, we might soon, by proper action, have set matters right; but while it is one thing to be told you are asleep, it is quite another and more serious thing to shout it from the housetop that we are "played out." Of all the reprehensible pieces of folly which have marked the course of the political exploitation of trade during the last seven or eight years, the worst has been this proclamation from places high and low that the British manufacturer is "played out," "on his last legs," and so on. The foreign buyer may reasonably judge that when we are advised to wake up he will hear of our renewed activity, but if it be drilled into him that we are "going to the dogs," "have no future," and so forth, he will not hesitate to place his confidence and his orders elsewhere. However little truth there may be in an assertion, if you hammer at it frequently enough, whatever your object may be, the assertion will be believed entirely by some as though it were the "whole truth and nothing but the truth."

The fact is that there are boundless initiative and enter-

prise ability amongst us; the pity of it is that we have not brought them to bear when and where they have been necessary.

Two "trade ambassadors" representing the Bristol Chamber of Commerce have been studying affairs in "the Antipodes," proceeding thence by different routes, and we read on their return, that "almost everywhere they were told by commercial men that England is 'played out,' and is unable to comply with the reasonable trade requirements of Australia." It is a serious thing when this impression gains such a hold. When one inquires into the reason for its existence, one hears the same old story, told by ourselves and others on so many occasions in recent years. American and German manufactures are used in preference to British, and it is "entirely the fault of British manufacturers and their method of doing business." The fact is that knowing the unwillingness of some British manufacturers to depart from their old methods and produce goods specially designed to meet the needs of a particular market, German, French and American firms have eagerly embraced the opportunity of strengthening their position and weakening ours, by supplying exactly what is required instead of adopting the "take it or leave it" attitude. In this direction there seems to be pressing necessity for us to wake up, and we had hoped that the reiteration of this need, almost *ad nauseam*, was bearing fruit, but Sir Robert Best says that in Australia there is still painful evidence of the disinclination of the British manufacturer to familiarise himself with the particular wants and requirements of the people. Sir Robert urges that early efforts be made to arrest the present diversion of British trade to these other countries, and he holds, as the result of observation, that our traders have it in their power to do this. One point coming in for attention is the need for British manufacturers to have a salaried agent out there, several firms keeping their samples in his hands. British manufacturers are cautioned against appointing Australian agents who are somewhat closely allied to Continental or American firms, to whom they may be inclined to give the preference.

The report does not appear to bear directly upon electrical manufactures, but we all know that a large quantity of foreign-made electrical goods find their way into Australia, and we trust that our readers will searchingly investigate the question, and see whether the strong condemnation of British methods given by these Bristol travellers is applicable to them in their own study of the needs of Australian electrical buyers. Let us, electrically at any rate, give the lie to the "played out" allegation. But let our Colonial relatives see to it also that they do not put obstacles in our way and so favour our rivals.

About an Australian Contract.

In our last issue we asked Canada what was the value of her nominal Preferential treatment of British manufactures, if lurking in the background behind that lower tariff there was to be an anti-English spirit. This week, we regret to say, we have to put an equally distasteful, but plain, question to the Government authorities in Australia.

To-day we are doing an increasing electrical business in Australia, and we have been living in hopes of doing far more in view of the developments that are in progress there, seeing that our firms are more active in their attentions to the market than they were, but if the Powers that be have an antipathy to us, we shall labour under difficulties which will strain our confidence, and lead us to discount professions of friendliness and family feeling. We are afraid that sometimes there is too little disposition to strain a point in favour of the British manufacturer.

"If you must come in—well, we will let you, but if we can do without you, we mean to do so." That is a chilling sort of reception to give to a blood relation, but it certainly describes the attitude of some Australians occasionally. So far as it indicates the old independent self-help British spirit—which we all display when we get abroad very much as we do at home, though there (who knows?) we may apply it first in the interests of our Colonial home, and secondly, in the interests of the Mother Country—it cannot be objected to if everything is perfectly fair and above board. Nobody can be surprised if Australians desire to keep manufacturing in their own hands provided they can do it satisfactorily and at a reasonable figure. But we are surprised, very much surprised, when after firms in this country have been expressly invited to tender for work, they receive cold-shoulder treatment though they have taken a great deal of trouble. From what we read in the Australian newspapers, considered in conjunction with advices received from our own correspondent, cold-shouldering is but a mild expression to apply in a recent case. "Gross unfairness," "scandalous treatment," and other such terms, better indicate the kind of controversy that has been raging in the Australian Press, as the matter could not be ventilated in the proper quarter while Parliament was closed. It does not require even an engineer to know that electrical manufacturing, or high-speed engine building, cannot be economically or efficiently carried on unless there be a fairly large and continuous demand, with men of specialised training and experience at the helm. But this is practically what the Fitzroy Dock Department—a Government establishment—is ambitious to do. It knows nothing of electrical manufacturing, and little enough of high-speed engine building we believe, yet it managed to put in a tender against British and Australian firms who had years of experience in these important lines. If it were already fully engaged upon such operations with a complete organisation, staff and equipment suitable therefor, it might be able to manufacture economically; or if it were going to pursue a definite policy of making such lines for the future, it might be more easy to understand. But how far is it going to manufacture? How low was its tender? How did it manage to get in a quotation for electrical goods if it was not going to manufacture them, and to secure for that quotation preferential treatment? These and a number of other interesting questions have been asked, and we hope that they will continue to be put until some satisfactory answer is forthcoming.

We wish we could spare space to enter into the full details, but we must content ourselves with stating them briefly. In December last firms in this country and in Australia were, by public advertisement, invited to tender for a power generating station equipment for the Lithgow Small Arms Factory, New South Wales. A number of tenders were submitted by English firms through the Commonwealth Offices in London, others tendered in Australia. From the London batch three were selected and sent out for final consideration with those received locally. One might naturally have supposed that it was intended to allow private enterprise to have free play. In due time, however, it was known that the contract was awarded to one of the Government's own Departments at £6,946. Awkward questionings then were fired, and strong criticism was offered in the daily Press by the Electrical Employers' Association (whose president and vice-president for their persistency and scathing attack have our hearty congratulations), there were deputations to Ministers, and a protest to the Premier. The ambitious Fitzroy Dock management, who would like to make *Dreadnoughts*—a Government Department, let us repeat—were on the alert for a job. Brilliant idea! Let us, a Government Department, who can make some things at present, but not others, get on our own a tender from an electrical firm for the electrical plant we cannot make, and put in a price to compete with these foreigners, and "keep the contract in Australia." And this in spite of a recent statement of the Minister of Defence that the "New South Wales Government Yard is not allowed to compete against private firms!" It is a typical illustration of the professed desire to assist private enterprise being accompanied by practical competition therewith, by setting up clothing factories and other such businesses.

It is said that Fitzroy Dock could make the boilers and the engines, but would need to go outside for the electrical outfit—so that there is really at bottom no likelihood of the electrical machinery being made on Australian soil. What is the good of keeping the *contract* in Australia if you cannot make the goods there? They will have to be imported, and the Government able to make one part of the contract, will hall-mark the goods of one particular firm and

put in a tender for its machinery. Naturally the other tenderers are up in arms and want to know why one electrical manufacturer should have been asked and not all. If Fitzroy Dock Government officials wanted to act fairly and squarely, why did not *they* issue an advertisement asking for tenders for the electrical requirements only? The galling part about the whole business is that a well-known firm in this country put in a tender which was actually lower by some hundreds of pounds than the total tender of the Government Department which quoted to the Government. Why was it passed over?

The Fitzroy tender, it seems, provided for the steam plant being entirely of local manufacture (made on Cockatoo Island), excepting "parts such as boiler tubes and headers and boiler plates, which cannot be made in Australia at present." It was said that only one firm in Australia could manufacture the electrical plant, and only one firm was manufacturing high-speed engines, and the prices would have been higher by some thousands of pounds if either of them had been given the contract. As it is then, at Fitzroy Dock Works they will make the engines, and as they cannot make the electrical plant, it will be imported. Why allow one electrical importer to be favourably placed because of Government adoption? may well be asked again and again. Is it certain that that private tenderer has quoted lower than any of the other firms for the electrical machinery only, or than any of the other tenderers might have been able to quote as sub-contractor to the Fitzroy Dock for that part only of the contract? And was quality of manufacture taken into account? Here is one of the statements of the Electrical Employers' Association, claiming for its members, even at the eleventh hour, their just due:—

> We object to the Fitzroy Dock as a Government institution representing themselves (*ipso facto*) as selling agents for a certain electrical firm, and at the same time giving that firm the advertisement that the hall-mark of N.S.W. Government approval is on their goods. We as taxpayers also contribute to that hall-mark.
>
> From the standpoint of the public, I may mention that twelve great electrical firms are represented here. Now it stands to reason that were competitive prices asked for, the public purse would have benefited.

The Government say that the Fitzroy tender was the lowest, but the President of the Electrical Employers' Association, knowing the total of that tender, and having in his possession copies of English tenders, has publicly and definitely refuted such a statement when made by the Minister for Home Affairs.

Fitzroy Dock lamely excused itself for selecting one firm by saying that if it had put the matter open to all and sundry, American competitors would have come in and carried off the contract. Really this is too childish. Was not the advertisement for the whole work issued broad cast? What was to prevent an American competitor putting in for that? And what need was there for the Dock Department to tender at all for the electrical equipment that it could not make?

It is regarded by our electrical friends in Australia as nothing less than a public scandal for a Government department to tender in conjunction with a selected private firm for Government work. We also so regard it, and we hope that common fairness will be meted out before the matter is finished with.

The Furness Co-partnery Scheme Rejected.

When the men at the West Hartlepool Shipyard with which Sir Christopher Furness is connected decided, practically unanimously, to give a 12 months' trial to the scheme of co-partnership which Sir Christopher proposed, we remarked that the men were far ahead of their trade-union leaders, who had not a good word to say for the scheme. With the single exception of, we think, Mr. Richard Bell, one of the broadest-minded and farthest-seeing of the labour leaders, the men's official representatives did their utmost by their public utterances and in the interviews granted to the representatives of that section of the Press which they profess to despise, to discredit the scheme. The object was, of course, plain. There was no attempt to disguise it. The success of co-partnership means the death of Trade Unionism in its present militant form, with the possible loss of occupation of some of the paid officials. We had hoped that the results of the 12 months' experiment would have been to induce the men to turn a deaf ear to the professional agitator, and to give the system a more extended trial; but we regret to learn that the result of the voting on the question of its continuance has been in the negative. The number of co-partner members who voted was 656, and the majority against continuing the scheme was 52, or about 8 per cent. of the total. The majority of the whole of the co-partner employés against the continuation was 106 on a poll of 1,096, or about 10 per cent. A large number of employés did not vote at all, so they were probably indifferent as to the result. We learn, however, that the works' council, who were appointed to settle differences between the masters and men during the 12 months' trial, have expressed deep regret at the result of the vote, and we share their regret. What the next step will be we do not venture to prophesy, but this we do believe, that co-partnery will continue to make headway in engineering and other industries, in spite of Trade Union opposition, just as it has done in the gas industry. If Trade Unionism stands in the way—well, so much the worse for Trade Unionism in the long run.

The Development of Electrical Machinery.

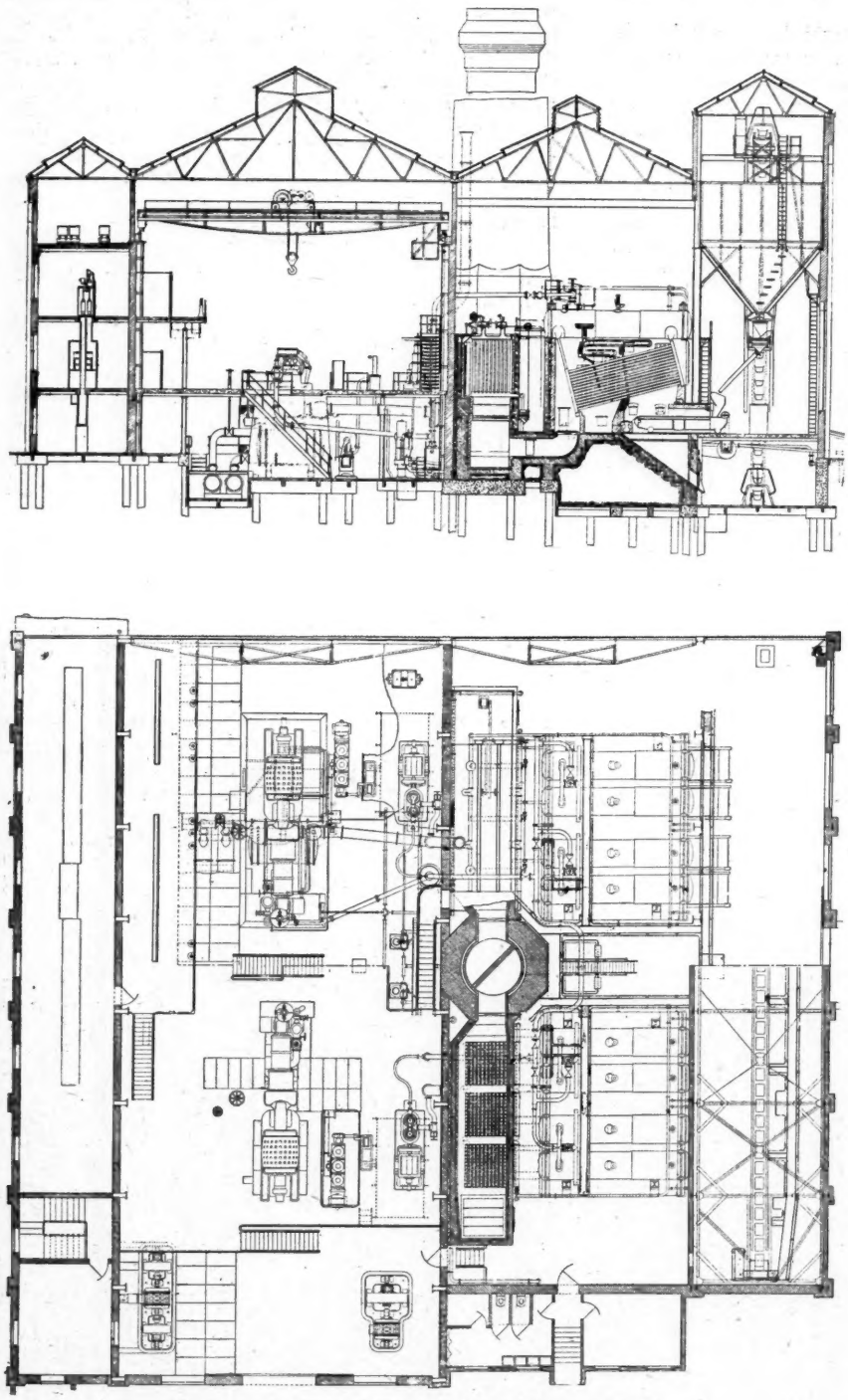
The enormous growth of the Commonwealth Edison Co., of Chicago, is shown in the present generating capacity of the system, which now approximates to 240,000 KW. This plant, large as it is, seems to be quite inadequate to meet the growing demand, for it is announced that two new generating stations are to be erected forthwith, each having a capacity of 120,000 KW. When completed, they will bring the total plant up to 480,000 KW. The most remarkable feature of these extensions is the size of unit contemplated. Already the Commonwealth Co. has been extremely enterprising in the size of its individual generating sets, six units each of 14,000 KW. being under erection at the present moment. The new stations, however, will be provided with turbo-generators of 20,000 KW. each, which easily constitutes a world's record. The rapidity with which designers of generating plant have met the demand for large units is a notable feature in electrical science; but though, in comparison with the average size of generating plant in operation, they show a striking development, one must not forget that 20 years have elapsed since Ferranti essayed to build 10,000-KW. sets for the London Electric Supply Corporation.

The new plant of the Chicago Co. is not only worthy of special mention on account of its size, but as exhibiting widely different characteristics from English practice. The most notable departure will be in connection with the steam-raising plant, which is to be designed for a maximum pressure of 250 lb. to the sq. in. It is obvious that this will materially affect the steam consumption of the plant, but what is of equal importance, it will have some considerable bearing on the floor space, which is a matter of very great moment. Indeed, one may go so far as to say that one of the chief difficulties in operating large units of generating plant is that of conveniently arranging the boilers. How far this is effected in the case of the new Chicago units may be gathered from the fact that a 20,000-KW. set will demand a boiler room area of 8,800 sq. ft., while a 12,000-KW. unit in operation occupies 5,740 ft. Taking the area occupied per kilowatt of plant, this works out in the case of the large unit at 0·594 sq. ft., as against 0·700 sq. ft. for the smaller plant. There is another striking difference in the machinery from an English point of view, in that the turbines are to be of the vertical type. It is somewhat strange that while in England this arrangement is being relegated to the region of the unfashionable, there is so striking a repetition in America. From this it is quite evident that the vertical turbine has proved perfectly satisfactory, and, after all, we presume it cannot be said to have been a failure in this country, but nevertheless there is an overwhelming amount of prejudice against it in Europe, and it is to be expected, therefore, that notwithstanding any merits possessed by the arrangement, there is not likely to be a very large increase in its use. It merely remains one of those curious and inexplicable differences in national practice, of which the high-speed engine is a conspicuous example.

THE DUNDEE MUNICIPAL POWER PLANT.

(*Concluded from page* 518.)

The extra H.T. switchgear occupies three floors. The ground floor contains the cable dividing boxes, static dischargers, and isolating switches; the bus-bars are on the first floor and the oil switches on the second so as to be free and get-at-able. The whole of the extra H.T. switchgear is contained in moulded concrete cells, no brickwork of any kind being used. The bus-bars are in duplicate, and the two sets can be paralleled through an oil switch. Each bar is isolated in a cell by itself, and only having connection to its own phase, the risk of a breakdown on any part spreading is greatly reduced. Static dischargers are provided on the outgoing feeders. The oil switches have two breaks per pole, and each of the three phases is contained in a separate cell.



Sectional Views of the New Dundee Power Station.

The whole of the switchgear was supplied by the British Thomson-Houston Co. The A.C. control board and the D.C. main board are situated on a gallery 11 ft. above the engine-room upper floor level. The boards are of white marble. On the A.C. control board indicating lamps show whether the oil switches are in or out. A synchroscope with indicating lamps is mounted at either end of the board on swing panels in full view of the operator. Triple-pole time-limit overload relays are used on the feeder and motor-generator panels and Andrews reverse-power relays on the latter. A Tirrill regulator is installed for keeping the voltage constant in spite of the variable tramway load. Special attention was given to earthing the framework, &c., in a very substantial manner.

There are three sub-stations besides the part of the main generating station allotted to sub-station machinery. These are situated at Clepington, Lochee and Dudhope. Lochee and Clepington sub-stations are similar in construction; Dudhope sub-station is part of the old generating station altered to suit.

The transformers and rotary converters are on the ground floor, while the H. and L.T. switchgear is situated on a gallery.

The extra H.T. switchgear is in similar moulded concrete cells to the switchgear of the main station, but the oil switches are mechanically operated. The bus-bars are so arranged that various sections may be separated if desired. On both incoming and outgoing E.H.T. feeders, static dischargers are provided, while reverse-current relays are in circuit with the incoming feeders. In the Clepington sub-station there are at present two rotary converters supplied by the British Westinghouse Co., each of 550 KW. By means of a double-throw switch on the machines, these may be used as shunt-wound machines suitable for lighting loads or compound-wound machines suitable for running on traction. Each rotary is combined with an A.C. booster, which boosts the low-tension volts up or down, so that the machine is capable of giving any pressure from 400 to 550 volts on the direct-current side. A 610-K.V.A. three-phase to six-phase oil-cooled transformer is provided for each machine.

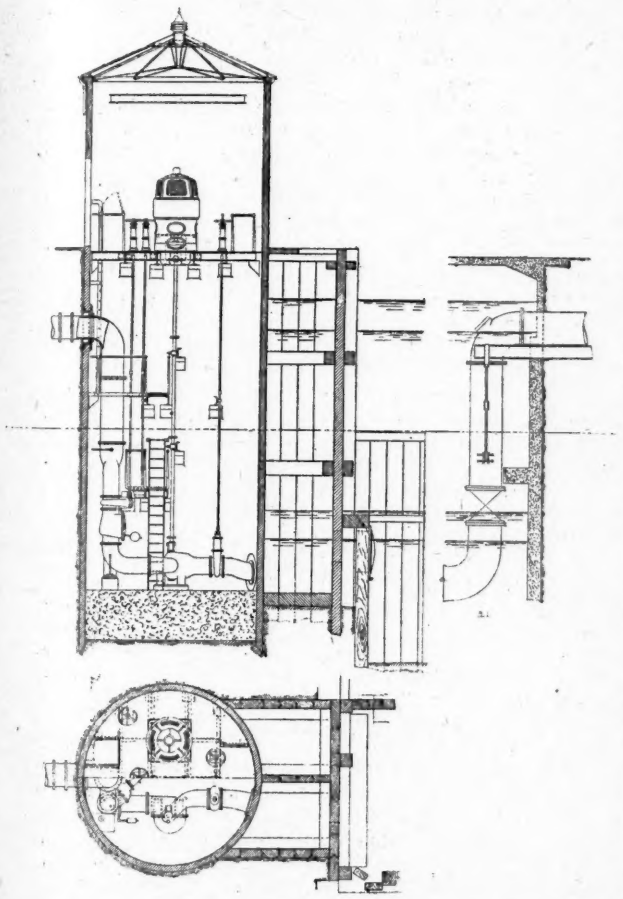
At Dudhope there are three 550-KW. 400/550-volt rotary converters, and at Lochee there are two 250-KW. 400/550-volt machines similar to those described above.

On the D.C. switchboards, reverse and overload circuit-breakers are in circuit with the machines.

The extra-H.T. cables were manufactured and laid by the British Insulated and Helsby Cables, Ltd.; the cables are three-core, paper-insulated, lead-covered, double-steel

armoured and jute-protected, with B. of T. earthing strip under the lead and insulated from it by a strip of paper. The cables on being completed at the works were tested with an alternating E.M.F. of 20,000 volts between cores and 13,000 volts between cores and sheathing, and after being laid and jointed were tested to pressure of 13,000 volts between cores and between each core and earth.

From the generating station ·1 sq. in. three-core cables are laid in duplicate to Clepington and Dudhope sub-stations, and ·05 sq. in. three-core cables in duplicate between Dudhope and Lochee. The total length of extra H.T. cables connecting the generating station and the sub-stations is about 12 miles. The cables for about ¾ mile from the main



VIEWS SHOWING ARRANGEMENT OF CIRCULATING PUMP ROOM, SETTLING TANKS AND DISCHARGE OUTLET.

generating station, owing to the nature of the ground, are laid solid in creosoted wood troughing and covered with tiles. Where the cables pass under the lines of the Dundee and Arbroath joint railway they are drawn into 6-in. fireclay conduits laid with a slight fall to either end in order to carry off any water which may accumulate through condensation, &c. The conduits are embedded in concrete, and lead into special manholes.

The remainder of the cables are laid direct in the ground at an average depth of 4 ft. 6 in. and 8-in. apart. After being laid they were heavily coated with a preservative compound and then covered with a specially shaped tile 2½ in. thick, with skew ends for jointing.

Where the cables leave the main generating station, and where they enter the sub-stations they are supported on heavy wrought-iron brackets keeping the cables 12 in. apart. The brackets are placed at 3 ft. centres.

The joints are of the usual H.T. type, each phase stepped. The Board of Trade strip, lead and armour is electrically continuous throughout.

The joints, after being completed, were troughed and run in solid with bitumen.

After a series of tests the sheathing of the cables where found necessary was bonded to the city waterpipes.

As previously mentioned, the circulating water for the new station is obtained from the River Tay, in which the maximum rise and fall of the tide amounts to nearly 18 ft. To reduce the power required, and also to avoid the necessity for constant regulation due to a varying head on the pumps, it was decided to use a closed system of piping, and arrange the outlet of the discharge pipe below water level, the arrangement adopted being shown in our views. The condensers are well above highest water level, and consequently the internal pressure is less than atmospheric pressure, especially at low tide.

The outlet pipe passes through the concrete wall of the Eastern Wharf, and then turns vertically downwards, ending with a short bend in a horizonal direction. The mouth of the bend is 2 ft. below lowest water level. The top of the condenser is 19·9 ft. above O.D., and on test a mercury gauge showed a vacuum of 22·8 ft. of water, while the tide was 22·7 ft. below this level. The measurements could not be made very exactly owing to fluctuations, but they show that the pipe was running full bore. Some months later, during a specially low tide, a gauge connected to the main pipe in the engine room showed a vacuum of 20 ft., while the tide was actually 20·1 ft. below this point. In the main supply pipe in the engine room at the same level, the vacuum was 12 ft. of water. The difference of 8 ft. is about the normal frictional head, so that the full effect of the return flow is utilised. To make sure that water can always be obtained in emergencies, the pumps are arranged below lowest water level and can be speeded up to deliver the full quantity of water should the siphonic action fail altogether. Automatic reflux valves are fitted at the pumps enabling all ordinary control operations to be carried out from the power station. At first these valves closed with considerable shock, but this was greatly lessened by fitting a small valve on the main one, opening in the reverse direction and closing with a spring.

A pump room constructed of reinforced concrete was sunk at the waterside. This is 14 ft. internal diameter and 27 ft. deep from the ground level to the bottom floor. On the river side of the pump room are two settling tanks constructed of reinforced concrete and having removable covers for cleaning. The pump room contains two 16-in. diameter vertical-spindle centrifugal pumps situated on the bottom floor and driven direct by two vertical electric motors of 63 B.H.P. each, fixed at the ground level. The motors are started and controlled from the engine room, and have a wide range of speed regulation. The main circulating waterpipes have spigot and faucet joints where laid in the ground, and flange joints in the engine room. The pipes rest on a reinforced concrete raft supported on reinforced concrete piles, and as a protection from corrosion the pipes were coated internally and externally with Dr. Angus Smith's solution, then asphalted ⅛ in. thick and covered with 6 in. of puddled clay after they were laid. The inlet and discharge ends of the pipe are both below lowest water level, to allow of siphonic action being taken full advantage of.

At the highest point of the system a single-throw Edwards air-pump is connected by means of a barometric pipe to deal with the air that has been carried in with the water.

In conclusion, we are indebted to Mr. Richardson for the particulars and views here given.

THE NEW ELECTRIC LIGHTING ACT.

THE Electric Lighting Act, 1909, which came into force on April 1st, is not going to bring about anything like a revolution in the supply of electricity. Time was when people were exercised as to whether the supply of this form of energy should be in the hands of local authorities or private companies; and whether, if Parliament granted power to any company or local authority within a definite area, the body upon whom these powers were conferred should enjoy a monopoly. The hand of time has softened these disputes, and the new Act, which came into

force at the end of last week, is really more of academic than practical interest.

Nevertheless, it makes certain important alterations in the administration of the law relating to electricity, and it is to these changes that we propose to draw attention.

First as to the origin of the measure. The principal changes which it makes were recommended so long ago as 1898 by a Joint Committee of both Houses, which was presided over by Lord Cross. That Committee recommended that "undertakers" (to use a phrase which includes both local authorities and companies supplying electricity) should be allowed to acquire land compulsorily for generating stations, either within or without the area of supply, and that they should have power, subject to the protection of vested interests, to lay the necessary mains outside their areas. What a mint of money would have been saved if this recommendation had been carried into legislative effect 12 years ago! By this time all the required generating stations are built, and in many cases they occupy most unsuitable and expensive sites. To go outside the area and select a site where coal could be obtained from a neighbouring canal was not permitted.

The new Act provides (by Sec. 1) that land may be compulsorily acquired under the terms of a provisional order, whether situated within or without the area of supply, or in the case of a local authority whether situated within or without their district. Provision for compulsory purchase may be made in a provisional order of the Board of Trade; but it is subject, of course, to the payment of adequate compensation. The price payable to the owner is based upon the value of the lands to the owner at the date of the notice to treat, and not their value when taken by the promoters. The question is not, what the person who takes the land will gain by taking it, but what the person from whom it is taken will lose by having it taken from him. It is customary to add a percentage to the value of lands taken under compulsory powers, and in most cases 10 per cent. is now adopted. This percentage may be taken to cover various incidental costs and charges to which an owner is subject whose land has been taken, and if no percentage were added, such incidental costs and charges would have to be considered in assessing the amount of compensation. The costs of any arbitration are settled by the arbitrators, and are borne by the promoters of the undertaking, unless the arbitrators award the same or a less sum than has been offered by the promoters of the undertaking. In the latter case each party must bear his own costs incident to the arbitration, and the costs of the arbitrators must be borne by the parties in equal proportions.

The Lands Clauses Act applies, subject to the modification that the word "land" include easements in or relating to land. It follows that if there were a piece of land with a private right of way across it, steps could be taken to compulsorily buy out the person claiming the right of way. Again, if the owners of property adjoining the proposed site claimed a right to light coming over it, a provisional order could be obtained to enable the undertakers to negotiate compulsorily with the person claiming the right to light.

The second section provides that a generating station may not be constructed on lands acquired by agreement (unless the land is specified in a provisional order), unless the construction is authorised by the Board of Trade. The Board of Trade may not give that authority until the views of all the owners and lessees of land in the neighbourhood have been consulted.

Hitherto it has been possible for undertakers who have power to purchase land by agreement for the purposes of a generating site, to choose any site that may be convenient, irrespective of owners and lessees of land in the immediate neighbourhood. For the future, a generating station cannot be built on any land without the consent of the Board of Trade; and that consent can only be given after the persons affected have had an opportunity of being heard. The object of this change in the law is to protect owners and occupiers from any risk of nuisance; for if land is acquired by compulsion, the person acquiring it is less exposed to actions for nuisance than persons who acquire it by agreement. As Lord Blackhorn said in Geddis *v.* Bann Reservoir, 1878, 3 A.C. 430:—"It is now thoroughly well established that no action will lie for doing that which the Legislature has authorised, if it be done without negligence although it does occasion damage to anyone; but an action does lie for doing that which the Legislature has authorised, if it be done negligently. And I think if by a reasonable exercise of the powers either given by statute to the promoters, or which they have at common law, the damage could be prevented, it is, within this rule, negligence not to make such reasonable use of their powers." There is no doubt that the extension of this principle to electrical generating stations will be a boon to undertakers, for there are many reported cases in which their business has been seriously hampered by actions for nuisance. For instance, in Shelfer *v.* City of London E.L. Co., 1895, 1 Ch. 287, it was shown that, owing to excavations for the foundations of engines, and to noise and vibration from the working of them, structural injury was caused to a house, and annoyance and discomfort to the lessee. Both he and the reversioners brought actions against the company, and were held entitled to an injunction.

There have been many other cases in which undertakers have been seriously hampered by actions for nuisance. In future, if persons living in the neighbourhood of a generating station have had an opportunity to appear and object, they will have but small ground for complaint in an action for nuisance.

This provision does not apply to transforming stations; the Act contains no definition of the terms "transforming station," "converting station," or "distributing station," but the definition of theset erms presents no difficulty. It will be remembered that by Sec. 38 of the Regulations made under the Electric Lighting Act, 1888, "transforming stations or points in a system of distribution, in which a high pressure supply is transformed for the purpose of supply to a consumer, and which are not on the consumer's premises, shall be established in suitable places which are in the sole occupation and charge of the owner."

Certain other provisions of the Act may be briefly noticed. In order to facilitate the building of generating stations outside the area, power is conferred on the Board of Trade to authorise the breaking up of streets. If the local authority concerned withhold their consent to this being done, the Board of Trade may dispense with that consent. "Supply in bulk" may be authorised by provisional order unless, by reason of the character or magnitude of the proposed undertaking, the Board of Trade think that the matter ought to be dealt with by private Bill. In this case, again, supply in bulk may involve interference with roads and streets outside the area, and if the local authority concerned make any unreasonable objection, their consent may be dispensed with.

With regard to supply outside the area of supply, it has long been felt that there ought to be more latitude than there has been. Even where a consumer's premises have been situated on the boundary line of a supply area, he has, strictly speaking, been unable to obtain energy from one source for the lighting of all parts of his premises. In future, if it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board may, if the local authority within whose district the premises are situate, and the undertakers, if any, authorised to supply electricity to those premises consent, by order, permit the first-mentioned undertakers to give a supply to those premises on such terms, and subject to such conditions as the Board think fit. Here again the undertakers, whose area of supply is being invaded, may not unreasonably withhold their consent. This provision will, in all probability, be strictly construed. A consumer in whose district energy is supplied at 5d. per unit would probably not be allowed to take a supply from a neighbouring area merely because energy could be supplied from there at 2·5d. per unit.

A most important section of the Act is that which enables two or more "undertakers" to obtain a provisional order permitting them to join together in the exercise of their rights and privileges. Unity means economy in the distribution of electricity for light and power; and by a judicious application of the powers conferred by this section there will be nothing to prevent undertakers from forming a joint

board to control the supply of electricity over a large area of country.

Other sections provide for a reduction of the period for revision of prices from seven years to five years, the making up of the accounts of undertakers to March 31st in each year; a return to the Board of Trade of reports made by auditors; and restriction on transfer of powers of the undertakers, except in accordance with the terms of a provisional order or special Act.

The most important provisions of the Act are those which relate to private supply. It is, in the first place, provided that a man having a private supply shall not be allowed to use the public supply as a stand-by unless he is prepared to pay the undertakers such minimum annual sum as will give them a reasonable return on their capital expenditure, and will cover other standing charges incurred by them, in order to meet the possible maximum demand for those premises; the sum is to be fixed by arbitration in case of dispute. This will get over the difficulty now experienced by undertakers, who may not show undue preference to any consumer, or refuse a supply merely because the consumer has a private installation.

The other part of the Act which affects private supply deals with companies and persons who, having a private installation, have supplied their neighbours' lamps for a consideration. In some districts a profitable "trade in electricity" has been carried on in this way without the sanction of a provisional order or special Act. In future (subject to certain exceptions) this will not be allowed in any district where there is a provisional order in operation. The undertakers will there have a monopoly. The section, however, will not prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of energy to consumers, nor will it affect companies who at the passing of the Act were supplying electricity to railway companies for auxiliary purposes.

A SHORT FLAME ARC LAMP.

A novel and interesting arc lamp known as the Timar-Dreger lamp has recently been developed by the Gesellschaft für Elektrotechnische Industrie in Berlin, and is described by Prof. W. Wedding in the *E.T.Z.* No. 2, 1910.

In this lamp, which is a plain series one with very little mechanism, the carbons lie horizontally with the positive one above, and nearly parallel to, the negative one, and, in order to get a more uniform light distribution, a second similar

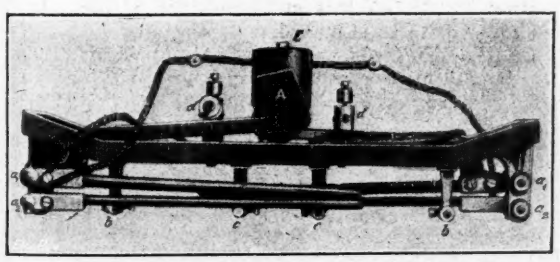


Fig. 1.

pair of horizontal carbons is usually fitted in the same globe but pointing in just the opposite direction, and both sets of carbons are kept burning at the same time connected in series. Fig. 1 shows a side elevation of the arrangement, and fig. 2 a plan from underneath. The four carbon holders are arranged free to rotate about horizontal axes a_1, a_2, and are movable through a small angle by means of the common electromagnet E.

When the lamp is switched off, the ends of the upper positive carbons are in contact with the respective lower negative carbons. When current is switched on and the series electromagnet E becomes excited, both its armatures are attracted and thus cause the carbons to separate a short distance and to strike the arc.

The base of the lamp is formed by the cast-iron plate B (fig. 2) which also acts as reflector. To this are attached the four axes a_1 a_2, and the four limiting pins b c. Two of

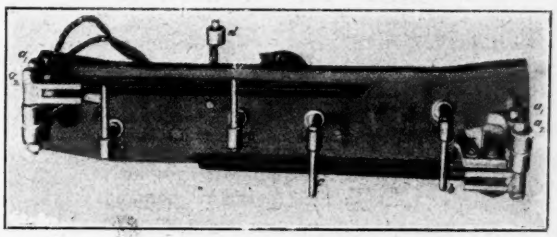


Fig. 2.

these pins (b b) serve to support the negative carbons, and are placed close to the carbon holder, so that when practically the whole carbon is burnt away it drops off the pin and opens the circuit as shown in fig. 3. The other pins (c c) are only for the purpose of alignment. The length of carbon left in the negative holder when the lamp is automatically extinguished in this way is about $1\frac{3}{4}$ in.

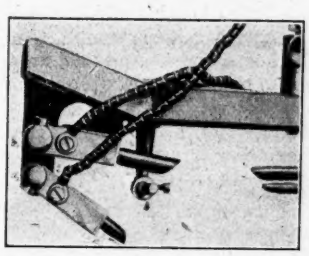


Fig. 3.

In order to improve the light distribution in the lower hemisphere, the upper (positive) carbons are rather longer than the lower negative ones, as shown in fig. 4. The arc is at the same time driven outwards by the electrodynamic action of the magnetic field of the arc itself, and in this way a good projection of the light downwards, without shadows, is effected. It is not necessary to be very particular about the adjustment of the relative lengths of the + and − carbons, as, even if the negative is made the longer to begin

Fig. 4.

with, the negative burns away more quickly than the positive (due to the concentration of the heat from the positive upon the negative) until the negative is shorter than the positive by a definite small amount.

The complete lamp is shown in fig. 5 with the cover open and in fig. 6 with it closed. Its over-all diameter is 20 in. and its height is 12 in. The globe itself is only $4\frac{3}{4}$ in. high. In a later form of the lamp the diameter of the globe is made the same as the maximum diameter of the case, so as to obtain all the light possible—even that thrown in the horizontal direction.

The lamp tested by Prof. Wedding was a 110-volt 10-ampere one, and it was under observation for over three months. It was fitted with oval carbons, the positive ones having the two dimensions in the ratio 13 : 9, and the negative ones in the ratio 11 : 7. With carbons 13 in. in

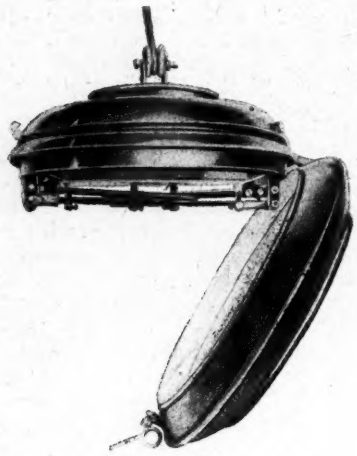


Fig. 5.

length the lamp burns for about 7¾ hours, but more recent designs, with the same overall dimensions, have been arranged to burn for 10½ hours, and a magazine lamp with 16 pairs of carbons has also been constructed, and burns for 72 hours with little alteration to the compactness.

When switched on to 110 volts, the lamp was found to light up satisfactorily always, and a recording ammeter in

Fig. 6.

series with it only showed fluctuations of ± 5 per cent., as with other flame arcs. No accidental extinction of the arc occurred during any of the tests. By varying a resistance placed in series with the lamp, it was found possible to alter the current from 11 amperes to about 3 or 4 amperes before the arc became unsteady. At about this current one of the magnet armatures usually fell and extinguished one of the arcs by letting the + and − carbons come into contact. The second arc would then continue to burn with improved steadiness, as the current would rise to about 6 amperes; the voltage across the lamp terminals being only about 51.

Occasionally the arc did not start quite at the ends of the carbons, but in such cases the steady condition was attained in about half a minute.

With this type of lamp the light emission is not the same in all vertical planes through the lamp, and, therefore, the candle-power curves had to be taken in three principal planes at 45° to one another.

Fig. 7 shows the curve obtained without a globe in a plane at right angles to the length of the carbons. The current was 9·95 amperes and the voltage 94·5. The hemispherical candle-power works out at 4,609 Hefner C.P., corresponding to a specific consumption of ·204 watt per Hefner C.P.

Fig. 8 shows the same thing for a plane at 45° to the former, and fig. 9 for a plane at 90° to the first (*i.e.*, in the plane of the carbons). Fig. 8 corresponds to a mean hemispherical candle-power of 4,420 Hefner C.P. with a current of 9·96 amperes and a pressure of 94·3 volts, so that the specific consumption is ·212 watt; whilst fig. 9 works out at 4,146 C.P. and a specific consumption of ·228 watt. The mean specific consumption is, therefore, ·215 watt per hemispherical Hefner C.P.

The lamp is also being made with a single pair of carbons; this throws the light chiefly in one direction, and is especially suitable for window illumination and similar work.

COPPER.

An interesting comparative record of copper outputs for various countries is furnished by a table issued by Messrs. H. R. Merton & Co., bearing date March 30th. This table gives the figures for the past 19 years, where obtainable. Taking the leading countries first, we find that the United States has increased its output from 116,325 tons in 1890 to 490,310 tons in 1909. The rise in production has been fairly steady; an almost stationary period is observable from 1899-1901, and the most marked increase is quite recent—*i.e.*, the returns for 1909 (from the New York *Engineering and Mining Journal*) are 67,010 tons better than those for 1908. Of the districts, the most marked improvement is that of Arizona, which has risen from 15,945 tons in 1890 to 129,945 in 1909, doubling its output in the last 7 years. Montana, while heading the list with 140,665 tons, has not been so rapid in its rise.

Mexico, with 56,240 tons, is next in importance. Expansion of output does not, however, appear to be practicable, as since 1905, when the figure was 64,440 tons, there has been a marked falling-off.

Spain and Portugal also have remained almost stationary over the whole period. Their output for 1909 was 52,185 tons, which was exceeded in 11 of the years under consideration, the highest being 1892 with 56,492 tons.

Japan is next on the list, with 47,000 tons. This, again, is lower than formerly, 1907 showing 48,935 for that country.

Chile has 35,785 tons, and Australasia 34,400. These are both lower than in preceding years.

Of the minor producers, Peru shows up well with 16,000 tons (and should be capable of expansion), and Norway has made good progress up to its 9,080 tons. Great Britain, of course, is negligible as a producer, only registering 700 tons, while in 1890 it managed 935.

North Germany has been fairly steady, and shows, for 1909, 22,455 tons.

On the showing of the whole report, it appears that expansion of production is taking place wherever practicable. The Copper Producers' Association estimate that during February stocks on hand were increased by 3,448 tons

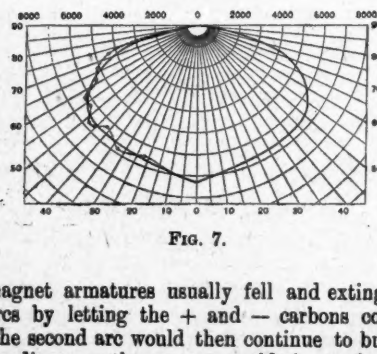


Fig. 7.

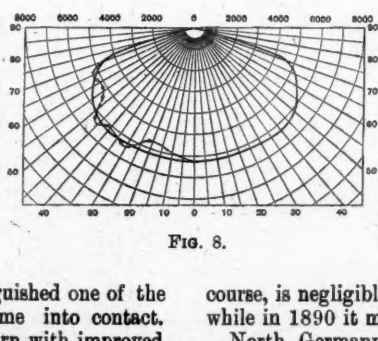


Fig. 8.

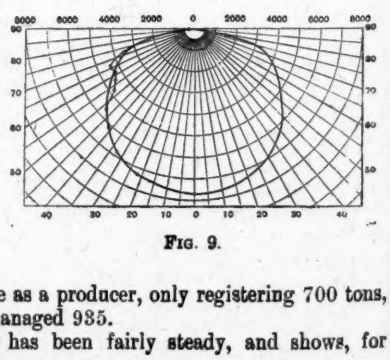


Fig. 9.

These figures they account for by the fact that the curtailments of December and January have not yet been reflected in the statements, and anticipate that in future the production will be smaller. The visible supplies are estimated in the same article as 113,460 tons, with 47,851 tons on hand, in the States. This, of course, is against increase in prices.

On the other hand, the work of associating the copper interests still goes forward. The *Mining World* of March 19th has an article on the constitution of the Amalgamated Copper Co. This company does not entirely own or operate any mining properties, but has investments in the stock of a number of the leading concerns, representing a controlling interest in the following:—Anaconda, Boston & Montana, Butte & Boston, Parrot, Trenton, Washoe, Big Blackfoot Milling, Diamond Coal & Coke; and has a strong holding in the Butte coalition. These companies had an aggregate output during 1909 of 130,311 tons of copper, besides silver and gold. The directors of this company are: John D. Ryan, Benjamin B. Thayer, James Jourdan, John Bushnell, William Rockefeller, J. Horace Harding and A. C. Burrage.

The Anaconda, which is under the presidency of Mr. B. B. Thayer, is now looking into the mines and smelters of the companies to be taken over in that particular section of the combine. These are given, in the Chicago *Mining World's* article under March 19th, as the first seven of the companies above mentioned, as well as the Butte coalition. The North Butte Co. is not included in the rumour at present. The properties are being valued out, according to this information, for adjustment of the various shares.

This looks very much as if the "combine" were merely a better adjustment of existing co-operation, with a view to lower establishment charges. Of course, the holding of so many controls by one company points to steady and constant work in one direction, but the consolidation does not, under this aspect, appear as of recent date.

Messrs. Merton's report for the month ending March 31st, 1910, shows visible supplies very slightly reduced to 111,432 tons (end of February 113,455). Supplies from North America are markedly low, amounting to less than two-thirds of the average for the past 12 months. Spain and Portugal have sent about their average (1,747 tons), Chile shipments are stronger, while Australian are a little below. Under present conditions, shipments, being affected by freights, and other circumstances, assist very little in deducing the feeling of the market. For the first time for 11 months, however, we have deliveries exceeding supplies, by 2,023 tons only, but still sufficient to furnish an indication. The bulk of the stock withdrawn, is from English ports, the French accounting for 352 tons.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Electrical Industry and a New Organisation.

Mr. Matthews does not in any way attempt to justify his position, and that of the self-consecrated Committee of the Electrical League, by refusing to make a clear statement of the results of their last endeavour to form a progressive combination of men interested in the electrical industry. If they do not wish to make public the method in which the funds of this defunct League were disposed of, I challenge him to send round at once to all the members, setting forth a full and clear statement for them at least to know how and to what purpose their contributions were spent. If Mr. Matthews and his self-appointed Committee would do less talking and more work something might be done, although, perhaps, not just what they want.

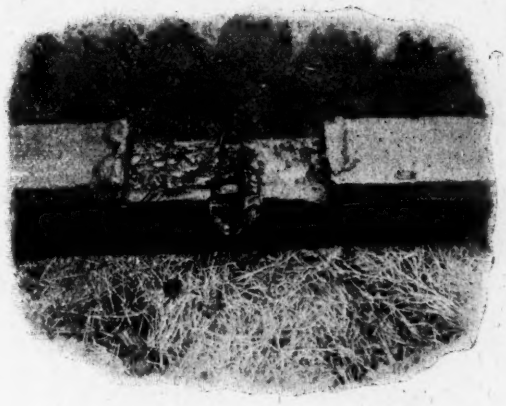
Mr. Matthews is not the man to hide his light under a bushel, and, therefore, if he is not ashamed of the results of the early attempts at co-operation, let him show forth to the world that he is able to carry out in practice what he has often put forward as being possible in his various contributions to the Press.

Once Bitten, Twice Shy.

A Gas Company's "Pushing" Methods.

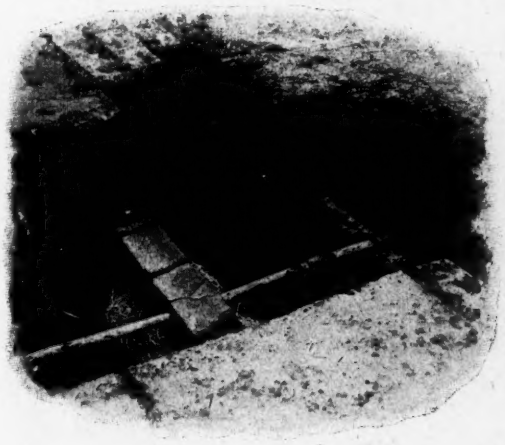
Enclosed you will find some photographs illustrating the method the gas company have of laying their services in this town.

Instead of opening up the footpath, they drive a crow-



bar under it, irrespective of anything there may be in the way.

Although this gas service was *pushed* through our cable trough 18 months ago, the earth fault did not show itself until recently, but when it did there was no mistake about



it. The cable is Callender's ·125 concentric V.B. insulation, and one photo. shows the outer exactly as it appeared after the pipe was removed.

The gas company are paying the damages.

F. R. Batty.

Northallerton, *April 1st*, 1910.

A Winnipeg Contract.

The digestion of your article on the above matter would infer that preference is given by Canadian engineers to Canadian manufactures, and in the case of your figures to the degree of $26,644. This reference, however, is incorrect, and the comparison of figures without details of the offers is very misleading. The price quoted for a contract is of very little consequence. The decision should be given in favour of the best offer or the best value for money. It is quite common knowledge that some of the designs submitted were not of the latest and in accordance with best practice for the service. As a matter of fact, some tenders were not even suitable for the 6,000-volt pressure, and would not capably deal with the extra-high-pressure and the conditions of supply. I have had occasion to interest myself in two schemes lately, one for 45,000 volts, and the other for 22,000 volts. The prices submitted for either scheme varied up to 70 per cent. In the case of the 20,000-volt

scheme, two switchgear contractors' prices varied by £1,800 for a £4,900 job, but by examination of the offer in detail it was found that half of the necessary gear was omitted in order to put through a low figure, and the entire absence of protection for the control of the high-tension feeders was noted. Hence, a comparison of prices is not a satisfactory comparison at all. When the proper basis of detail was investigated, the variation in price in this case was only 2 per cent.

In the case of the 45,000-volt scheme, there appears to have been only one engineering firm who realised that extra-high tension gear has to be designed, and that it is not sufficient to put forward a 6,000-volt scheme. The prices in this case varied by 60 per cent.

Personally, I am pleased to note that Canadian engineers are very thorough in detail and select the top scheme regardless of price, the lesson to English contractors being that a thorough scheme of efficient design is what is to be expected from the Mother Country.

Alfred G. Collis.

Manchester, *April 5th*, 1910.

[We fear that our correspondent's "digestion" is out of order, for his remarks appear to have little bearing on the substance of our leaderette. If he will take the trouble to read the latter, he will find that only three tenders satisfied the conditions, and of these only two—those of the Westinghouse Co. and Messrs. Siemens Bros.—came under consideration for final adjudication, the tender of the Canadian General Electric Co. offering "nothing superior to the other two." "According to the engineers, there was not much difference between the Westinghouse and Siemens tenders." Moreover, the difference in price was, as we said, nearly $5,000; yet Mr. Collis chooses to represent us as saying that preference was given to Canadian manufactures to the degree of $26,644. He also assumes that the Canadian engineers selected the Westinghouse tender on the score of technical merit; but merit did not come into the question at all. "There was not much difference" between the two, and the third selected tender "offered nothing superior to the other two"—how then can Mr. Collis make out that the English tender was rejected on the basis of merit? We should think that Messrs. Siemens Brothers would have something to say to this.

Our complaint was that the decision was based not upon technical merit or price, but upon the vague and shadowy grounds of "sentiment, caution and conservatism," and certain alternative excuses superficially of a technical nature, but which our correspondent does not attempt to justify.

As for the other two schemes mentioned by Mr. Collis, they have nothing to do with the case under consideration, in which no fault was found with the English tender.—Eds. E.R.]

LEGAL.

Northern Counties Electricity Supply Co. *v.* Todd.

At the Morpeth County Petty Sessions on the 30th ult., William Todd, butcher, of Seaton Hirst, was summoned by plaintiff company for the balance of an account for energy supplied. For the plaintiffs, it was stated that the proceedings were to recover 2s. 2d. due for electricity supplied during September last. The defendant had paid a portion of the account in July last to the company. The company had put into force a new scale, and had notified all their consumers of the fact. The point at issue was whether the energy should be charged for under the new scale or the old. In 1906 the defendant entered into an agreement for a supply, under which the company might alter their charges from time to time.—Mr. J. W. Bell, secretary to the company, said the rate in force at the time of the agreement was 5½d. per unit, but on May 28th, 1909, a notice was sent out to all consumers stating that during the summer quarter, a minimum charge of 5s. 10d., irrespective of the amount of electricity used, would be made. If the consumer used above 10 units he would pay under the old scale of 5½d. per unit. The account for the quarter ended September, 1909, was sent to defendant, and in December a further account, which included the charge for the previous quarter, was rendered. On February 1st the defendant sent a cheque for £1 2s., which was 2s. 2d short of the account. The defendant had written to the company saying that he had only burned eight units, and he was not going to pay for more than he had used. The company replied that the defendant had agreed to the conditions already mentioned as to a minimum, and they could not make any exception in his case. The defendant said he had entered into an agreement with the company 10 or 11 years ago. There were no conditions attached to the agreement such as had been stated. He paid under the old scale of 5½ d. per unit until six months ago, when the company demanded 5s. 10d. He had only used eight units during the quarter, which came to 3s. 8d. He deducted the amount, and told the plaintiffs that if they were not satisfied they could cut off the supply.—The Chairman of the Bench said that legally the defendant was wrong, and made an order for the payment of the full amount, and costs.

Autoclaw Co., Ltd., *v* Jackson & Co.

With regard to the above lawsuit, reported in our last issue, Mr. H. C. Barlow, of the firm of H. C. Barlow & Co., Salford, who gave evidence in the case, desires us to make it quite clear that he has no connection whatever with the defendant's firm, but was a quite independent witness.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Arctic Fans.

The Wilson-Wolf Engineering Co., Ltd., Thornton Road, Bradford, send us particulars of their "Arctic" fans, of which one is illustrated herewith. They are now able to supply these, direct-driven, up to 72 in. in diameter, D.C. or A.C.

The motors are of the enclosed pattern, and can be made totally enclosed. They are fitted with a combined thrust and journal ball bearing, and are, therefore, suitable for fixing in any position. The blades of the fan are of the propeller type, which the firm consider,

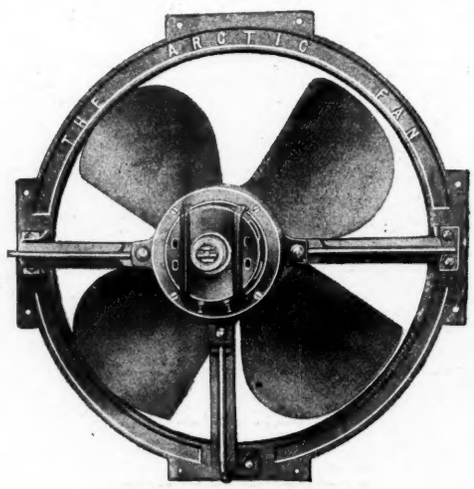


Fig. 1.—"Arctic" Fan.

after a large experience and a good deal of experimenting, the most efficient form, combining rigidity and great air-propelling power with efficiency and silence. They claim as much as 50 per cent. greater output at equal speed than with the average box-blade fan.

The totally enclosed pattern is quite suitable for exposed situations, and the firm make special types for use where chemical fumes are to be dealt with.

They have recently put on the market a complete line of A.C. fans, similar in mechanical construction and appearance to the D.C. fans. The motors are of the induction type, with squirrel-cage rotors, and can be supplied for any phase, periodicity, or voltage.

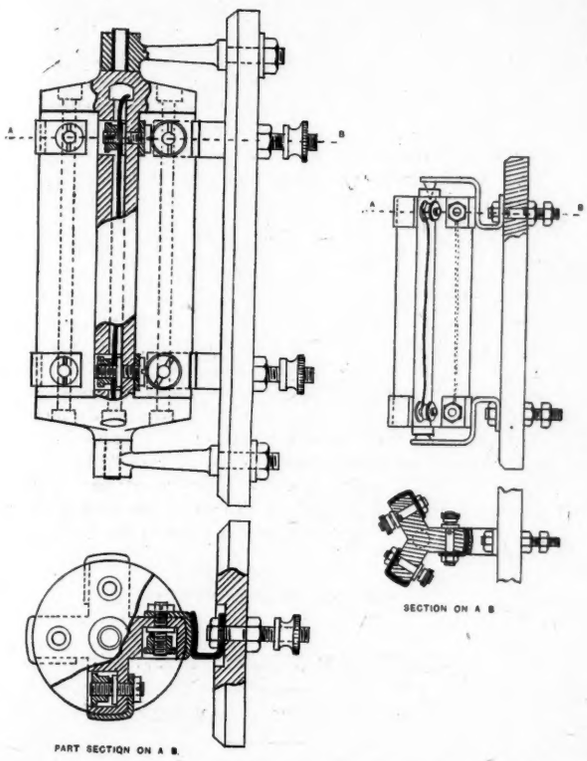
Mercury Ammeter.

In the *Electrical World* of the 24th ult. some further particulars are given of the "mercury internal-pressure ammeter," which we have previously noticed, and which is now being put on the market by the Leeds & Northrup Co., Philadelphia. This instrument is capable of measuring currents up to 50,000 amperes, D.C. or A.C., on a scale like that of a thermometer, 53 cm. in length. An accuracy within 0·1 per cent., over 4/5 of the scale, is claimed for the readings, which are proportional to the square of the current, so that the scale will be close at the lower end and open at the other. There is no appreciable zero error, and no error due to ordinary variations in room temperature; and the instrument need not be carefully levelled. The liquid indicating column returns from full load to zero in about 4 secs. after the current is cut off. The constant of the instrument can be determined by calculation, and does not change with time. The resistance is extremely low.

A Replacement Fuse Carrier.

The want of a serviceable multiple fuse carrier is often brought home to people in charge of power and lighting installations. It very often happens in works employing a number of motors, distributed about, that the blowing of a fuse means 15 minutes' or more delay before the electrician is forthcoming with the correct fuse wire. This delay is all the more irksome when 20 or 30 men have to stand idle with the motor.

The larger size of carrier, here shown, is designed for power or



Figs 2 and 3.—Replacement Fuse Carriers.

large mains protection, and constitutes a safety as well as a replacement fuse, whilst the smaller size is intended for lighting circuits and house services. The carriers are of moulded porcelain, and in the case of the larger size the carrier is free to turn on trunnions at its extremities, the spring action of the contacts holding it in position.

The fuse wires are threaded down cored holes in the carrier, thus ensuring safety. Blown fuses can be replaced at leisure while the current is on. Another feature of this carrier is that it can be used as a double-pole fuse by providing an additional set of contacts.

The inventor of this fuse carrier is Mr. J. H. Noble, "Hillsborough," Radcliffe Road, Coventry.

Callender's Patent Diver's Lifeline.

In the old-fashioned diver's lifeline, any wires embedded in the lifeline itself were of the ordinary rubber-insulated type, generally consisting of a single-wire conductor. When strain came on the lifeline, the latter stretched, but the copper wire would not stretch to a corresponding extent, and the result was that the wire broke; thus communication would be interrupted probably at the most critical moment, when possibly the diver was entangled in some obstruction under water and pressure was being put on him by means of the lifeline, and he would be unable to telephone his instructions because the wire had snapped.

In the patent lifeline introduced by Messrs. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C., the insulated conductor is made extensible, and, in fact, the conductor will stretch very much more than the manilla rope. This is accomplished by using a rubber core consisting of high-class rubber, on which is wound spirally the conductor, which consists of a number of very fine copper wires; the whole is then insulated with a sheath of high-class rubber. No tapes or braids are put over the insulated conductor, so that the result is a combination of very high-class rubber with a corkscrew spiral, and it is obvious that this will extend to any degree, in fact, until the rubber parts, without interrupting communication. One such insulated conductor is neatly implanted in the middle of each strand of a three-stranded manilla rope, composing an effective lifeline with means for telephonic communication that will not give out when the strain comes on the lifeline. The importance of this invention to the brave men, whose calling causes their lives to depend almost literally upon a thread, is self-evident.

Siemens "Onewatt" High-Candle-Power Lamps.

We have received from Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E., a sample of the new "Onewatt" lamps which they are placing on the market. This, we are informed, is a tungsten lamp, having a filament of drawn tungsten wire, which is mounted on a frame in a single continuous length, like the tantalum filament. The efficiency of the new lamps is 1·1 watts per candle, and they are at present supplied for 100 c.p., for use on circuits at 100-130 and 200-250 volts respectively. The lamp is a very handsome piece of work, having a spherical bulb, and should prove highly suitable for shop and street lighting; it can also be arranged for lighting living rooms by frosting, or enclosing it in a globe of opal glass, which by reducing the intrinsic intensity of illumination produces an exceedingly soft and pleasant effect.

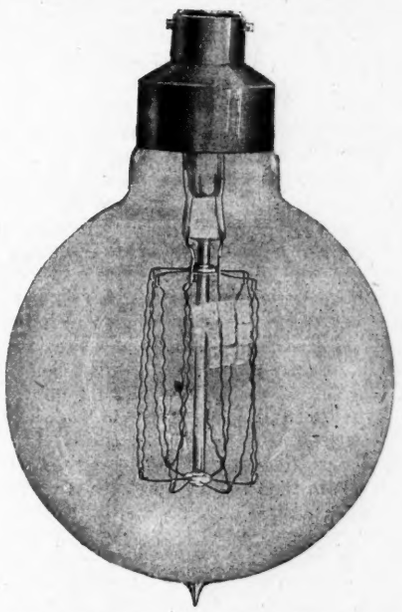


Fig. 4.—"Onewatt" Tungsten Wire Lamp.

We understand that Messrs. Siemens Bros. are also placing on the market a range of "Onewatt" battery lamps with filaments of drawn tungsten, having an efficiency of about 1 watt per c.p. The makers are to be congratulated on the remarkable progress made in the construction of tungsten lamps; although they took front rank in the development of the metallic-filament lamp with their process of drawing tantalum into wire—of which they still retain the secret—they have not taken up any of the known processes for the manufacture of tungsten filaments, but have waited, apparently, until they could repeat their triumph by drawing tungsten into wire.

ELECTRIC HEATING.

[COMMUNICATED.]

The subject of electric heating is by no means exhausted, in spite of the pessimism with which it has been regarded in Great Britain. This is amply proved by the revival of interest which has taken place since the introduction of the Therol system of heating. Perhaps this is due to the attractions with which the possibility of a 100 per cent. load factor is surrounded, and also to the amazing simplicity of the means by which this result is produced. Whether or not it will be successful in practice appears very largely to depend upon the question whether or not the current consumption of various houses can be sufficiently standardised to enable a uniform capacity of heater to be installed in a large number of houses in a given area. For example, if, say, 60 houses in a given supply area had each a normal 300-watt lighting load, it would pay the supply authority to install 300-watt heaters in such houses on the hire or hire-purchase basis, either charging the whole consumption for lighting and heating on a flat rate, or providing a two-rate meter operated in conjunction with the change-over switch from the day or heating circuit to the evening or lighting circuit. If, however, it were found in such a district that the lighting load of various houses ranged between 100 and 600

watts, it would be a difficult matter for the supply authority either to stock a range suitable to the needs, or so to proportion the charges for heating and lighting as to meet the requirements in every case. Another factor in the situation is, of course, the precise amount of hot water that an ordinary householder requires during the day. This may vary considerably with different families, and therefore the due proportion of a heating arrangement might be a matter of some difficulty; this is, however, a matter for experience to determine.

The revival of interest in heating problems which this proposition has induced encourages us, however, to discuss one or two other points concerning heating generally, which, so far as we are aware, do not appear to have been previously raised. One of these is the increasing tendency which is becoming evident on the part of electrical manufacturers unduly to cheapen the construction of electric appliances in order to bring down the selling price to a figure which is competitive, not only with other makes of electrical appliances, but also with other modes of heating. To a large extent this is good, but where cheapness is made superior to reliability an evil creeps in which may eventually do considerable harm to the cause of electric heating. Several forms of heating apparatus have, as their heating element, coils or strips of wire suitably encased in insulating material and placed immediately underneath a very thin sheet of iron plate. Under the coils again, in order to reflect the heat back to the upper surface, is usually a second plate, and in their anxiety to secure proper heat transmission through the metal of the top plate, and also to bring down the cost of the appliance, some makers have somewhat neglected the feature of mechanical strength, with the result in one case that when the cooking utensil was put into operation it was found that in from 10 to 15 minutes after the start the upper plate buckled to such an extent that much of its efficiency as a heating surface was destroyed. This emphasises a point which should be carefully watched, not only by manufacturers, but by all engineers of supply undertakings who do not wish the intrinsic value of electrical heating to be nullified because of bad construction: namely, that efficient heating largely depends on good transmission between the heating elements and the substance to be heated.

In a most useful type of electric heater which has been introduced within recent times, and which depends for its action chiefly upon Foucault currents generated by a small transformer in an iron plate in contact with the substance to be heated, an incidental effect has been noticed which, in the minds of inexperienced house-holders, may give rise to alarm. This is the fact that unless care is taken to maintain the iron plate in good mechanical connection with the transformer core, a certain amount of trouble is experienced from chattering. This, while perfectly harmless, is very disturbing, and it, therefore, gives emphasis to the fact that good mechanical construction is a *sine qua non* in electric heating.

Another important point which manufacturers of electric heating apparatus should bear in mind is that electrical insulation should by every possible means be kept up, and this is not an altogether easy matter where high temperature and rough treatment may be encountered, more particularly in the forms of heating appliances which are constructed so as to be portable. Let us take, for example, the new Quartzlite system of heating and cooking. In making reference to this particular system in this connection, it is not intended in any way to imply that the system is peculiarly open to trouble from this cause, but it is quoted as one of the latest words in electric heating, in order to show that if electric insulation is paramount in importance in this, it is equally so in all other forms of electric heaters. It will be known by most engineers that a spiral of nickel or similar wire threaded inside a quartz tube constitutes an element capable of withstanding a considerable pressure at its terminals. The wire glows and heats both the tube and the surrounding air. These tube elements where used for radiators or cooking purposes are arranged with six or so tubes in series in order to bring the combination up to the working voltage of the supply system. Evidently very great care must be taken to insulate properly every terminal, since on a 200-volt circuit with one wire earthed the voltage of one of the intermediate terminals may be raised to 165 volts above earth, and it would be quite easy to burn out the tubes if this terminal were in any way accidentally earthed. This demonstrates as a typical case one of the great points which must be borne in mind by electric heat appliance makers if such appliances are to be rendered absolutely "fool-proof." Nothing is so destructive of popular confidence as a shock.

While touching on the subject of electric heating, it may be wise to refer briefly to a tendency on the part of some supply authorities to cater unduly for heating load. Although we quite believe that in instances where it is required to bring the day load up to the capacity of one small machine, which would have to be run whether the load was good or bad, it is wise policy to stimulate electric heating by selling energy at 1d. per unit, yet this policy has its dangers. Using the term advertising in a broad sense, it must be admitted that many supply authorities have stimulated 1d. per unit heating load by means of wide advertisement, with the result that in some instances they must have gone far beyond the capacity of their day-load machine on the combined heating and lighting load. It is unlikely that in all cases this day load is being run on a paying basis. The question becomes still more serious when the influence of the electric radiator is taken into account; in most cases it will be found, except in business centres, that the radiator load practically coincides with the lighting load; that is to say, an increased peak is being put upon the station, this additional peak only earning revenue at what may be called the nominal rate of 1d. per unit. In the interests of the future of electric heating, it is well to discuss these points at the present time in order to avoid a serious set-back in the future.

SALE OF SCRAP METALS.

By HENRY M. SAYERS.

THE note on this subject in the ELECTRICAL REVIEW of January 14th raises a difficulty that need not exist. With a proper system of allocation the questions propounded settle themselves in automatic fashion. Whether the capital of the undertaking is raised by the issue of shares and debentures by a company, or of bonds by a local authority, and whether the original loan has been partly or wholly repaid, makes no more difference to the correct allocation of the receipts for the scrap metal sold from time to time than does the amount of the dividend paid.

The best practice is simply to credit each individual job with the value of the scrap material returned from it, and to debit it with the value of all new material expended on it. Then the net cost of the job is transferred to the proper account, whatever it may be, extensions, renewals, or maintenance. Old cable metal may be credited against either of these accounts, according to circumstances. Extensions may involve replacing smaller cables by larger ones, though the smaller cables would not under careful management be wholly scrapped. Replacement of faulty or broken-down cable, worn-out valves, and other wearing parts, comes under the head of maintenance, and is a purely revenue charge. Renewal of cable which has become weakened by overload or natural decay, or which has proved to be unsuitable for its purpose or working conditions, is properly charged against a renewal fund, accumulated from the annual surpluses. If there is no such fund, it is a charge on the current or future revenue, by a suspense account in the latter case.

There is another class of operations which is not covered by the above list, viz., the substitution of one system by another. To take a concrete example, most of the early alternating-current undertakings started with house transformers and high-tension distribution. The majority of them found it necessary to replace this system by large transformers in sub-stations and low-tension distribution. The cost of the change was usually and properly met out of

capital. Properly, because the objects of the change were to make a saving in working expenses, and to increase the earning capacity of the undertaking. Unless the increase of net revenue sufficed to give a reasonable rate on the new capital expended, it was not justifiable. This statement applies generally to cases of obsolescence. In such cases, the value of the material replaced, whether scrap value or use value, is properly placed to the credit of the substitution job account and the net cost of the operation charged against capital.

The effect of this method is that the stores account is treated like a cash account. The prices at which the scrap material is debited to the stores account and credited to the jobs accounts are best fixed at rates a little under known market prices, and any surplus obtained on sale is fairly treated as a stores account credit. The stores' wages and other current expenses should be covered by a small addition to invoice and contract prices in the rates charged for goods issued, together with such surpluses on sales, and if the rating is carefully done on both sides, the stores account will balance very closely every year. Any credit or debit balance goes to the revenue account as a "sundry."

Contracts for the supply, delivery and erection of plant, main-laying, &c., involving no stores labour, need not go through the stores account, but there will nearly always be some stores charges against such jobs for the supply of small parts, tools, or common materials, and these charges will be posted to the job or the contractor, as the case may be, in due course.

This method of dealing with stores avoids the difficulty of allocating on invoices, which frequently cover goods common to several accounts; it admits of balancing the stores accounts by value, and permits the use of any system of accounting for individual items which is found convenient. It requires the strict use of requisitions and credit notes, and admits of those papers, the first-hand records of issues and receipts from and to jobs, serving for the accountant's as well as the storekeeper's books. The storekeeper need not even price them out, or know the prices applied, if it is desired to keep them private.

It is advisable to apply the same procedure to carting, whether that is done by contract or otherwise. The engineer or foreman in charge of the work issues to the carter a carting order stating the job number, trip and load, and this order, initialled on execution, is returned by the carting contractor as a voucher from which the job is charged. The making good of paving, &c., after main-laying can also be dealt with in a similar way if the surveyor's department agrees to accept the orders in a suitable form. As the procedure is a convenience to the surveyor in showing him where work has to be done, and identifying beyond question the party for whom it is done, there need be no difficulty in getting the necessary concurrence.

It is sometimes difficult to get professional accountants to accept the system advocated, but in the case of companies the advantages are usually apparent to them upon explanation. With local authorities there may be more difficulty, as the old-fashioned system of cash receipts and payments is adhered to by many of them, and separate revenue and capital accounts must be kept. Probably the division of the stores into revenue and capital stores would meet most of the difficulty, but the disappearance of the old system as applied to trading undertakings, cannot be long delayed. Revenue and capital accounts in the usual trading form have to be kept as well, and the only apparent advantage of the old method is that it is easier to verify cash receipts and payments than the items of a trading account, a consideration, no doubt, when the only effective auditing was that of elected auditors, but of little value now that skilled auditing is, or should be, employed by every local authority.

London Fires in 1909.—The report of the Chief Officer of the London Fire Brigade for the past year shows that there were 3,197 occasions on which the Brigade attended fires, compared with 3,238 in the previous year; 62 were of a serious nature. All the telephone exchanges in the County of London are connected with fire stations, and in case of urgency one should not ask for the nearest station, but simply for "Fire Brigade." Oil lamps were responsible for 92 fires; electricity for 95; candles for 129, and gas for 236 fires.

BUSINESS NOTES.

Consular Notes.—Colombia.—The Belgian Consul at Bogota reports that the openings for electrical trade in Colombia are not very great. Electric lighting installations exist at Bogota (Compania de Energia Electrica), at Medellin (Sociedad de Luz Electrica) and at Carthagena (municipal works). Some agricultural and industrial establishments use electricity for motive power, and in particular one may mention the cotton works of R. Echevarria and Co., at Medellin. The telephone is used at Barranquilla and at Bogota, where the installation is exploited by the Bogota Telephone Co. (an English concern). The Tramway Co. of Bogota (American) propose shortly to install electric traction on the tramways of the town, which are now worked by horses. A similar project was mooted in Barranquilla, but appears to have been abandoned. In 1908, according to the figures of the Barranquilla Customs, Germany supplied the largest quantity of machinery (20,000 kg.), dynamos (44,000 kg.), lighting material (5,000 kg.), and porcelain insulators (11,000 kg.).

Australia and New Zealand.—The Belgian Consul at Melbourne reports that the use of electricity in all its forms is rapidly extending in Australia and New Zealand on a scale so large that one may safely say that these markets will soon acquire a particular importance in the matter of the sale of machines, apparatus, accessories, &c., for electricity. Already these articles are imported into Australia to the extent of 15 to 20 million francs per annum, and into New Zealand to the extent of 5 million francs. The native electrical industry is relatively so small that foreign manufacturers are almost in complete possession of the market. The United Kingdom is the principal supplying country, but the United States and Germany compete with a considerable amount of success in spite of the preference in the matter of Customs duties granted for certain British goods. There are a very great number of electrical works for lighting and motive power, and the use of electricity in mining operations is rapidly increasing. In many towns the tramways are worked electrically, and numerous industrial concerns use electricity. As regards contracts, the period during which tenders may be sent is not as a rule long enough to allow the agent to refer the matter to his principals in Europe or the States except by telegraph. It may be mentioned that the lowest tender is not necessarily accepted, much importance being attached to the reliability of the tenderer, the execution of previous works or supplies, &c. In general, it may be stated that the machines, apparatus, accessories, &c., in general sale in the United Kingdom and the United States, are those demanded in Australia.

Japan.—The Belgian Consul at Kobe reports that, in spite of the general abstinence of capitalists as regards the financing of new industrial enterprises which has marked the last two or three years, Japanese capital is always ready for new electrical undertakings. Seventy-eight companies are at present applying to the Government for concessions for the production of electrical energy, the installation of electric traction, lighting, &c. This preference for enterprises of this kind is explained by the fact that there are in Japan considerable water-powers not exploited up to the present, and that the tramway and electric lighting companies have shown such satisfactory results even in a period of crisis. Several of the companies in question, whose capital is only partly paid up, hesitate to make new appeals for funds, and voluntarily apply for foreign capital. The negotiations entered into with English houses established in Japan have resulted, in the case of two or three tramway companies, in the raising of loans, the lenders reserving the right to supply materials. The financial assistance of foreign countries appears to be likely to increase, as the interest on capital in Japan is a good deal higher than in Europe. The public finances of Japan have shown a considerable development during recent years, and call for a rapid commercial and industrial expansion. Foreigners can only hope to participate in the financial operations of electrical companies by employing a reliable agent on the spot. The same is true in the matter of the supply of material.

Impulse-Reaction Turbines.—Writing to us with reference to the "announcements which have been recently widely made relative to the appearance on the market of a new pattern of turbine—the so-called 'disk and drum' type"—Messrs. Brown, Boveri & Co., Ltd., remark that in fairness to the work of Messrs. Brown, Boveri & Cie., of Baden, it should be more widely known that this pattern of turbine has been regularly manufactured in their Swiss, German and French works for some time. Among the large turbines of this type which are in hand at the present time are a 5,000-kw. set for Essen, a 5,000-kw. set for Nancy, and a 10,000-kw. turbine for Paris, as well as a number of 12,000-h.p. and 14,000-h.p. turbines for the German and French Navies respectively.

The Paris turbine—which will be capable of developing 20,000 h.p. continuously—is, they say, the largest yet ordered for electric power purposes in Europe. Its destination is the St. Denis station (in which 10 6,000-kw. sets of their manufacture are already installed), and under the steam conditions prevailing there its steam consumption will be less than 8·8 lb. per b.h.p.-hour.

Regarding the foregoing communication, we feel bound to say that it is not our fault if Messrs. Brown, Boveri hide their light under a bushel, so that their turbines are not more generally known. From the tone of their letter one might infer that information regarding their manufactures had been suppressed, whereas, on the contrary, we are not only willing but anxious to keep our readers *au fait* with the latest developments in electrical machinery.

Bankruptcy Proceedings.—The Electrical and General Engineering Co., 17, Gracechurch Street, E.C.—Under a receiving order made against this firm, the first meeting of creditors was held on Friday, April 1st, at the London Bankruptcy Court. Mr. E. Leadam Hough, Senior Official Receiver, reported that a Mr. Joseph Augustus Bauer had attended under the order, and had stated that he carried on the above business, and also traded under the style of the Calux Electric Co., at 7, Great Winchester Street, E.C. It appeared from the debtor's statement, that he commenced business in the early part of 1895, at Leadenhall Street, with £100 capital of his own, and £450 borrowed from his father, but subsequently converted from a loan into a gift. He traded alone as the Electrical and General Engineering Co. for six months, but was then joined by a partner, who brought in a connection, but no capital. They traded as equal partners until 1902, when there was a dissolution, the debtor paying out his partner with between £100 and £150, and taking over the liabilities and assets. The business, which had in 1897 been removed from Leadenhall Street to Gracechurch Street, was quite solvent at the date of the dissolution. The debtor subsequently continued it alone, and under his personal supervision. In October or November, 1908, he opened an office at 7, Great Winchester Street, with a view to carrying out an agency contract which he had secured, for the sale of the Solium electric lamps, and traded there as the Calux Electric Co. He continued there up to date, although the Solium Co. went into liquidation last October. It further appeared that the debtor in August, 1907, made a private arrangement under which he paid some of the creditors a composition of 5s. in the £. He was a director of the Metals Corporation, Ltd., 85, Gracechurch Street, and claimed about £400 or £500 for outstanding fees, and £50 in respect of a loan to the Corporation. The latter, however, was practically dead, and there was but little prospect of recovering any part of the moneys. The debtor attributed his failure to cost of litigation, the collapse of the Solium Lamp Co., and loss of trade, and he became aware of his insolvency only in October or November last, when the Solium Lamp Co. went into liquidation. An action had been brought against the debtor by the British Tungsten Lamp Co., Ltd., of Liverpool, to recover £80; he had entered a defence on the ground that the goods were not up to sample, and counterclaimed £300 for damages, but the action was not yet set down for hearing. Several executions had been levied on behalf of creditors, but the Sheriff had retired upon becoming aware of the landlord's claim for arrears of rent. The receiving order was made on March 15th upon the joint petition of Messrs. Wentworth & Co. and James McDougall, Ltd., and the public examination of the debtor was fixed for April 28th. A statement of affairs had been lodged showing unsecured debts £3,053; a contingent liability of £390, which, however, was not expected to rank, and preferential claims, £35. The assets were valued at £455, and the deficiency was estimated at £2,633. The assets consisted of cash, £3 10s. 1d.; stock, £20 (estimated cost, £150); machinery and plant, £30 (estimated cost £150); fixtures, £40; 65 shares in the Aron Meter Co., Ltd., £32 10s.; 1,050 shares in the Metals Corporation, Ltd., £50; 12,000 shares in the Solium Electric Co. (in liquidation), no value attached; good book debts, £260, and doubtful and bad debts together amounting to £650, but only expected to yield £2 16s.9d.; total, £455. In reply to the Chairman, the debtor stated that he had placed £50 as the value of his holding in the Metals Corporation, because, although he had stated in the course of his preliminary examination that the company was practically dead, negotiations were on foot to restore it to activity, and it was probable that there was still some value in the shares. There was considerable discussion over a proof for £1,250 tendered by the debtor's father, who claimed in respect of money lent. Mr. Bauer, sen., explained that he had advanced moneys to his son from time to time, and in December last his solicitors obtained an acknowledgment of the amount then due. The chairman eventually admitted the proof for the purpose of voting. A resolution was passed for Mr. G. E. Corfield, chartered accountant, Balfour House, Finsbury Pavement, E.C., to act as trustee and administer the estate in bankruptcy, assisted by the following committee of inspection, viz, Mr. Baxby, representing the London Aluminium Co., Mr. Lake, and Mr. J. W. Ward. The trustee's bond was recommended to be for £400. Appended is a list of the creditors:—

Anchor Cable Co.	£17	Maxim Electric Co.	£24
Adnil Electric Co.	43	Morley Electrical Engineering Co.	39
British Tungsten Lamp Co.	80	McDougall, J.	19
Cardwell, Boorman & Ford Lloyd, Ltd.	13	Oldbury Steel Conduits Co.	15
Crompton & Co.	16	Piutte, Scheele & Co.	82
Davis Electric Co.	13	Wentworth & Co.	35
Electrical Co.	27	Ward, J.	46
Electrical Power Storage Co.	27	Parker & Richardson	290
Fernley, H. A.	18	Enever, C. R.	15
Faraday & Son	58	Hunter, A.	344
Hornsby, R., & Son	88	Bauer, J.	1,213
Indestructible Cable Co.	18	Bauer, F.	135
Lake, F.	41	L. & S.W. Bank, Ltd.	219
London Aluminium Co.	16	Contingent liabilities	390
Kilby & Gayford	20	Preferred creditors	73

Alfred Horswill Gibbings, engineer, 17, Gambier Terrace, Liverpool.—The first meeting of creditors herein was held on Wednesday, March 30th, at the Official Receiver's offices, 35, Victoria Street, Liverpool. The unsecured liabilities amounted to £2,234, with a further partially secured debt of £500, the value of the security being put at £10. The debtor, who at one time had held important appointments, commenced business in North John Street, Liverpool, as a consulting engineer, in February, 1906, in partnership. This connection was dissolved in June, 1908, and a considerable part of the indebtedness consisted of moneys due to the outgoing partner. The debtor continued the business and obtained several important engagements, including the North British Electrical Power Syndicate and a large Yorkshire enterprise. These, however, were all cut short by the passing in the last Session of Parliament of the Electric Lighting Act, which terminated most of his contracts by cutting off or largely limiting private enterprise as opposed to municipal undertakings. The assets, according to the statement of affairs, consisted only of furniture valued at £43, but it appeared that some time back the debtor had given a bill of sale on his furniture to his mother-in-law, resident in the Transvaal, to the extent of £200, upon which some question might arise. The administration of the estate was left in the hands of the Official Receiver.

William Charles Ellis, electrician, Applegate Street, Leicester.—The first meeting of creditors herein was held last week at the Official Receiver's office, 1, Berridge Street, Leicester, when no creditors attended or were represented, consequently no resolutions were passed. It transpired that the debtor commenced trading on his own account without capital in March last year, and took a small shop at Western Boulevard, and last December took his present premises, but has done very little business here. The debtor applied for an administration order about three years ago, under which payment was to have been made in full by 10s. a month on liabilities of about £40, but only part of these payments have been made. The bulk of the new liabilities are in respect of trade goods supplied. The failure is attributed to losses on three contracts, want of capital, and expenses through being sued by creditors.

Rinking by the "Osram" Light.—We have in several recent issues referred to the success of the metal-filament lamp in ousting not only high-pressure gas, but also in some cases arc lighting, for the illumination of streets and other large open spaces. Up to the present the flame arc lamp has held the monopoly for the lighting of large skating rinks, but apparently the many obvious

Rink Lighted with Osram Lamps.

advantages of the high candle-power Osrams have appealed to the proprietors of the Maida Vale rink—one of the largest and most popular in the kingdom. As will be seen by the accompanying illustration, this hall is illuminated entirely by Osram lamps, of which 60 400-c.p. and nearly 600 50 c.p., at 200 volts, are at present installed, the current being taken from the Metropolitan Electric Supply Co.'s mains. Some of the lamps appear black in the figure; this, we are informed, is because they were lacquered red, at the request of the proprietors.

Aluminium in France.—It is stated that various transactions have recently taken place in France at prices ranging from £3 12s. to £3 16s. per cwt., which represents a noteworthy advance over the average quotations for the metal at the beginning of January. But it is considered inadvisable to conclude from these operations that the condition of the aluminium industry has entirely changed in face of the circumstance that the productive capacity is greater than the requirements of consumers. The prices in question are only of importance in so far as concerns the particular quantity to which they apply, and apart from these orders, contracts were concluded some time ago at much lower rates than those mentioned for delivery up to the end of 1910. The period of the year has now been reached when stocks have been reduced to a minimum owing to the winter season, during which the available water-power is limited, and all the attention of producers is concentrated upon the execution of contracts, leaving to merchants the matter of attending to the needs of hand-to-mouth consumers. This is attributed as the cause of recent price increases which have been favoured by past speculations on the part of merchants, particularly in Germany. But the melting of the snow is commencing, the works will again have at disposal a large amount of water-power, stocks will be reconstituted and the question of over production will again arise, especially as the new works of Langentière, Saint Jean and Chippis will be set in operation.

Catalogues and Lists.—Messrs. Jens Orten Boving and Co., 9½, Union Court, Old Broad Street, E.C.—Eight-page pamphlet illustrating, briefly describing, and giving prices and dimensions of their "Victoria Safety" pumps which are made at Rugby.

The Electric and Ordnance Accessories Co., Ltd., Cheston Road, Aston, Birmingham.—Well illustrated booklet (No. M280) of 12 pages of art paper, entitled "The Modern Method of Driving Machinery." It contains some notes on the features and advantages of electric power, with special reference to the "E.O.A." electric motors. Information is given usefully comparing electric motors with steam and gas engines, also an account of the "E.O.A." hire-purchase system at a monthly or quarterly charge extending over one, two or three years. Prices of motors (semi-enclosed, shunt wound) of from ¼ to 25 B.H.P., and of control gear, are tabulated. A number of good and appropriate half-tone illustrations show the motor applied to the driving of different classes of machines. The publication should interest actual and prospective users of power.

Messrs. Brockie-Pell Arc Lamp Co., Wimbledon, S.W.—Four-page list giving some particulars of their "B.P." accumulators for ignition, car lighting, motor-cycle and other service, and 25-volt sets for metallic-filament lamp installations, also a table of capacities, prices, weights and dimensions.

Messrs. Woods, Sons & Co., 62-63, Queen Street, Cheapside, London, E.C.—Leaflet giving particulars and prices of their packing canvas, cord, twine, &c.

Messrs. Krupka & Jacoby, 61, 62, Watling Street, London, E.C.—Several new leaflets containing particulars and prices of incandescent electric lamps, portable electric drilling machines, bayonet lampholders, and flame arc carbons.

The Key Engineering Co, Ltd, 4, Queen Victoria Street, London, E.C.—16-page publication, fully describing the Key spring conduit (Nagel & Knight's patent) for interior wiring. Interesting photographic reproductions appear showing the wiring operations in progress. An accompanying leaflet gives a note of prices of ⅝-in. conduit and fittings.

The Sun Electrical Co., Ltd., 118, 120, Charing Cross Road, London, W.C.—32-page catalogue containing a large number of illustrations, prices and a few particulars of their "Sunlite" and "Sunline" reflectors for shop window lighting, interior and picture illumination, &c. Signs, enamelled outside lanterns, holophane globes, wireless cluster fittings and other lines, are brought together in this publication, forming a useful list for the contractor interested in work of these classes.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Price list C4 (superseding C3) of tantalum lamps, including the new focusing lamp noticed in our last issue. Also price list 4BT, giving particulars of the Siemens "Onewatt" lamps with drawn tungsten wire filaments, for 100 c.p. at 100-130 and 200-250 volts, 1·1 watts per candle. Contractors can obtain these lists, overprinted with their own names and addresses, free on application.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester.—Mains Section, List No. 4, of cables for electric lighting, power and traction purposes; a very handsomely produced volume, with excellent coloured illustrations of Messrs. Glover's cables, showing the steel, lead, copper and other constituents with remarkable fidelity. Besides full particulars and prices of cables, the book contains some useful tables and formulæ of general interest.

Book Notices.—*Annual Report of the Smithsonian Institution for* 1908. Washington: Government Printing Office. 1909.—The Appendix to the Report contains, amongst many other interesting articles, a paper on "Wireless Telephony," by Prof. R. A. Fessenden, read before the Am.I.E.E. in 1908, and the Kelvin Lecture (abridged) delivered by Prof. S. P. Thompson in that year.

"The Small Coal Question." London: The *Colliery Guardian*. Price 1d.

"*Bulletin* de la Société Internationale des Electriciens." Vol. X, No. 93. March, 1910. Paris: Gauthier-Villars. Price 2 fr. 50 c.

"Fire Tests with Roof Coverings." 1910. London: The British Fire Prevention Committee. Price 2s. 6d.

"*Bulletin* of the University of Kansas." Vol. XI, No. 1. November, 1909. Lawrence, Kansas: The University Experiment Station.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 3. March, 1910. New York: The Society.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIV, No. 1. 1910. With Index to Vol. XIII. 1909. Milan: Tipo-Lit. Rebeschini di Turati E.C.

"Il Nuovo Cimento." Vol. XIX, Fasc. 2. Pisa: Tipografia Pieraggini.

"Science Abstracts." Sections A and B. Vol. XIII, Part 3. March 29th, 1910. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"*Journal* of the Franklin Institute." Vol. CLXIX, No. 3. March, 1910. Philadelphia: The Franklin Institute. Price 50 c.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Spéciales." February, 1910. Liége: 23, Rue Agimont.

Fire.—It is reported that heavy damage was done by a fire which burnt out the premises of Vulcanite, Ltd., in Stour Road, Old Ford, Bow, E., on March 31st.

New Map.—Mr. Edward Stanford, of Long Acre, W.C., has issued from the Press a new coloured map of metropolitan railways, tramways and miscellaneous improvements for which proposals have been deposited at the L.C.C. for the 1910 session. The price of the map in sheet form is 2s., or, mounted in case, 4s. 6d.

Private Meetings.—R. A. Sibun & Co., electrical engineers, 3, Mulgrave Road, Sutton.—A meeting of the creditors of the above was held in London on Tuesday, at the offices of the debtor's solicitors, when a statement of affairs was presented showing liabilities of £829, of which £164 was due to trade creditors, the balance of £665 being in respect of cash claims. The net assets were estimated at £135. The solicitor stated that the debtor commenced trading for himself in the early part of 1908. At the outset he commenced with stock of the value of £130, £30 of which he paid for, and the balance of £100 was guaranteed by his uncle (Mr. C. Sibun). This amount had not been repaid, and his uncle was now a creditor on the estate for £100. The debtor had suffered considerably from bad health, and he had been unable to devote his whole time to the business, which had been carried on for him by a manager. The debtor's mother was a creditor on the estate for £415, money lent, while his sister was also a cash creditor for £100. These amounts had been advanced at various times. Some of the money had been used for the purposes of the business, and the remainder had been used to pay expenses which had arisen through the debtor's continued ill-health. The drawings from the business had been practically nil, and the present position had been brought about by the debtor's illness and the heavy expenses which had arisen in that connection. It was stated that there was very little hope of the debtor being able to continue the business, and the solicitor pointed out that if the estate came to be realised there would only be a very small dividend for the creditors. Provided that all the creditors agreed, the debtor's mother was willing to advance sufficient to pay the creditors a cash composition of 3s. in the £. This composition would be paid within 14 days. After a short discussion, it was decided to accept this offer, and in the event of all the creditors failing to agree it was resolved that the estate should be realised under a deed of assignment, with Mr. E. H. Hawkins, of Messrs. Poppleton and Appleby, chartered accountants, 4, Charterhouse Square, E.C., as trustee. The principal trade creditors are:—General Electric Co., £22; A. C. Hands, £35; Drake & Gorham, £20.

Stoker Contracts.—Among orders for stokers recently obtained by the Underfeed Stoker Co., Ltd, are the following:—

St. James' and Pall Mall Electric Light Co., 8 B.5 and four travelling grates; Brussels Exhibition, 1910, 10 E.; two Cotton Mills, Shanghai (repeat), 4 B.5; Anglo-Romano, Italy, 12 E.; Antwerp Electric Works (repeat), 4 E.

The Laundry Exhibition.—Electricity does not figure very largely at the Laundry Exhibition, which closes to-morrow, at the Agricultural Hall, London. The show, which is organised by Messrs. Cordingley & Co., in conjunction with the Laundry Engineers and Allied Trades, Ltd., is the largest of the kind that has so far been held, and illustrates in a striking fashion the wonderful progress that has been made in recent years in the art and industry of laundering. In fact, it may safely be said that the ordinary man—and woman—have but a faint idea of the great variety of machines—some of them of a heavy, and others of a most complex nature, that are required in a modern steam laundry. So far as we could gather from a brief visit to the Exhibition, the only exhibitors of electrically-driven machines are Messrs. T. Broadbent and Sons, Ltd., Central Ironworks, Huddersfield, and Messrs. Watson, Laidlaw and Co., Ltd., Glasgow, both of which concerns are showing hydro-extractors fitted with this system of driving. Messrs. Crossley Bros., Ltd., Manchester, exhibit one of their O E type gas engines specially designed for electric lighting purposes. It is of 160 B.H.P., and is coupled up to a dynamo, it being utilised for the lighting of the firm's stand.

Foster Lamps.—The Foster Arc Lamp and Engineering Co., Ltd., Worple Road, Wimbledon, announce reductions in the prices of "Foster Metallic Lamps."

Trade Announcements.—The Lancashire Electrical Co., of Pritchard Street, Charles Street, Manchester, want catalogues of motors and other electrical goods.

The B.T. Copper Works (Rai-Tillières, France) who have for some ten years past been doing business in England through factors, have now opened premises at 83, Goswell Road, London, E.C., where Mr. Albert Weill is acting as their representative. Copper wires, sheets, bars and bands, also brass wire, bars and segments, for electrical and other purposes, are among their specialities.

Mr. Brook Shaw, electrical engineer, has opened new premises in Orchard Place, Sheffield.

Messrs. James McMillan & Co, Clun House, Surrey Street, Strand, London, W.C., have been appointed sole agents for Great Britain for the Swedish Metal Works Co., Ltd., manufacturers of copper and brass, in sheets, tubes, wire rope cables, trolley, telegraph and telephone wire.

Messrs. Electrical Installations, Ltd., have removed to larger premises at 27, Martin's Lane, Cannon Street, E.C.

Dissolution.—Parkes & Pullen, mechanical engineers, Woodbridge, Suffolk.—Messrs. J. Parkes and H. S. Pullen have dissolved partnership. Mr. Parkes will attend to debts.

Gas Leakage.—Referring to "Borough Engineer's" letter on this subject in our issue of the 11th ult., Messrs. Bullers, Ltd., Tipton, point out that they manufacture and sell a very cheap and efficient ventilator for cable boxes, which, although it cannot prevent gas leaking, certainly renders the leakage quite harmless. This type of ventilator is in use in Sheffield, Birmingham, Oldham, Derby, Wolverhampton, &c.

LIGHTING and POWER NOTES.

Accrington.—Alderman Higham has reported to the Electricity Committee that he had, after being approached by Altham as to the lighting of the main road there, offered to undertake the lighting for the sum of £4 per lamp per annum for a minimum period of five years, such sum to cover the erection, maintenance and lighting during that time. The arrangement has been agreed to.

Ardrossan.—A B. of T. inquiry was held at Ardrossan in connection with an application by Mr. George Balfour, London, for a provisional order to supply electricity for lighting and power purposes within a district embracing the burghs of Ardrossan and Saltcoats, and the special lighting district of Stevenston. Several formal objections were submitted by a number of Corporations, public companies and works in the district. At the close it was stated that an arrangement had been reached between the promoter and the industrial concerns mentioned, while in connection with the opposition of the T.C. of Ardrossan, the Commissioner said he could not recommend the B. of T. to refuse the order merely because the promoter would be in competition with the Corporation.

Canada.—One of the recent contracts closed by the Electric Development Co. at Niagara Falls was an order calling for three generators of 15,000 H.P. each. Another contract of great importance has been closed by the Ontario Power Co., which is also largely increasing its output at Niagara Falls, and has placed an order for three generators of 12,500 H.P. each. Still another contract has been closed by the Western Canada Power Co., of Vancouver, B.C., for two generators of 10,000 H.P. each, making a total of over 100,000 H.P. in these three contracts alone. The addition of about 200,000 H.P. in sum total, including the smaller orders, to the output of producing electrical companies, means that they must see a market in prospect for the use of that amount of power.

Cape Colony.—A proposal has been submitted to the Cape Town Electric Lighting Committee by the city electrical engineer and the city treasurer, for defraying the cost of wiring installations by instalments. The Electric Light Department will draw up specifications and call for tenders from wiring contractors for the work, and if the cost is under £25 the customer will pay in 12 monthly instalments, with 10 per cent. interest added; if the cost is over £25, the instalments will be spread over two years. The payments will be guaranteed by the landlord of the property. The Council recently adopted a reduced scale of charges for large consumers as follows:—Up to 500 units per month, 3d. per unit net; from 500 to 2,000 units per month, 2½d. per unit net; from 2 000 to 4,000 units per month, 2d. per unit net; from 4,000 to 6,000 units per month, 1½d. per unit net; all above 6,000 units per month, 1d. per unit net. The Council supplies electric motors on the easy payment system on the basis of 30, 40 and 60 months' instalments.

Continental Notes.—Belgium. The electrical plant at the collieries of the Société des Charbonnages des Kessales, Jemeppe-sur-Meuse, is being extended. At the Kessales pit a new electric pumping plant and an electrical ventilator are being installed, while at the Bon Baveur pit the old steam winding engine is being replaced by an electrically-operated one.

France.—With a view of meeting the increased demand for current, the Société de l'Electricite de Paris has lately placed an order for a new 20,000-H.P. steam turbine and alternator, together with the necessary boilers, for its generating station at St. Denis. The new generating set is stated to be one of the largest of the kind in the world.

Dartford.—The U.D.C. has decided to supply energy at £5 per KW. and 1d. per unit to power consumers using not less than 250,000 units per annum.

Dublin.—Last week, Mr. Cowan, of the L.G.B., held an inquiry at the South Union Workhouse into an application by the Guardians for a loan of £3,000 for the purpose of lighting the premises by electricity. The clerk stated that the latest estimate from the Gas Co. for lighting the institution was £1,142 9s. per annum, which would include fittings and the maintenance of same, provided the Board gave a contract for either three or five years. Negotiations took place between the Board and the Corporation, and the offer of the latter was at 3d. per unit for electric current, provided a contract was entered into for five years. Mr. Raymond said he had a notice of motion on the agenda for the next meeting advocating the provisional adoption of electric lighting. The clerk read a letter from the Ampere Electrical Co., Dublin, offering to supply the Union with electric light for a period of 10 years at £750 per annum. At the end of 10 years the installation would become the property of the Board. A report from Mr. Lawless, C.E., on the lighting requirements of the institution was then read. The report stated that 1,950 points would be lighted, and for this 2,000 lamps would be required, the lamps being of varied power according to the position. Dr. Vincent Joseph Cullen said the wards were badly lighted when he came, and the light had got worse recently. They wanted nearly double the present number of gas jets. He was of opinion that gas vitiated the atmosphere. In answer to Mr. Crimmins, the witness said that electric light had replaced gas in nearly all the city hospitals. Alderman Dr. M'Walter stated that he was of opinion that there was a necessity, in view of the congested state of the wards, for having electric light introduced. Dr. MacNamara, resident medical officer, said he believed the introduction of electric lighting would be a great advantage. The people in the wards would be more healthy, and the hospital patient would recover more rapidly. Mr. W. C. Crimmins, a member of the board, also gave evidence in favour of the scheme of electric lighting. Mr. Lawless described the scheme, and said that at the end of 10 years the lighting bill would only amount to £720. The inquiry then closed.

Eccles.—The T.C. has arranged to supply electricity to the works of Nasmyth, Wilson & Co., Ltd., and the Winton Manufacturing Co., of Patricroft. For the former the mains will be extended at a cost of £1,200.

Edinburgh.—Following the example of the Dundee Corporation, the T.C. is considering as to the advisability of introducing electric light into common stairs of high tenements in the central parts of the city for reasons of health and convenience. The cost of incandescent gas is 17s. 6d. and the Electric Light Committee proposes a supply at the rate of 22s. 6d. per lamp. It has been agreed to offer 21s. per lamp.

Glasgow.—The T.C.'s Committee on Electricity has recently been considering the producing capacity of its two principal generating stations, and the expediency of steps being taken for the erection of an additional station to meet the rapidly increasing demands of the department. The engineer, Mr. W. W. Lackie, has now submitted a report, in which he points out that the maximum safe load on the two generating stations at Port Dundas and St. Andrew's Cross is 23,600 KW., and the maximum load during the past winter was 21,650 KW. Prior to the introduction of the metallic-filament lamp, the maximum demand increased at the rate of 3,000 KW. per annum. The engine rooms at Port Dundas and St. Andrew's Cross are both full of machinery. In these circumstances, it is desirable that the Committee should take into consideration, at the earliest possible date, what is to be done with the view of making adequate provision, not only as regards the probable demand for the supply of electrical energy two years' hence, but also as regards the supply for the next 10 years. At Port Dundas Station there are one or two small generating sets, which might be removed so as to make room for larger sets, but the objections to extending the plant at Port Dundas in this way are—(1) the unsatisfactory supply of water from the canal for condensing purposes, and (2) the high price which has to be paid for the delivery of coal at the works. The temperature of the canal water before entering the station is between 80° and 90°. This means that much larger condensing plant has to be installed. The cost of coal at Port Dundas is, roughly speaking, 10d. per ton more than at St. Andrew's Cross, which is due to the fact that at the former station there is no railway siding accommodation. I may also point out that the substitution of larger generating sets, to take the place of the existing small sets, would only be a temporary expedient, and would not solve the larger problem of an increased supply for the next five or ten years. In view, therefore, of the various considerations to which I have adverted, and of the fact that the erection of a new generating station upon any land that may be acquired by agreement will be subject to the provisions of Sec. 2 of the Electric Lighting Act, 1909, and that some time may be required for complying with those provisions, it is, I think, advisable that the committee should now be on the outlook for a site upon which such a station could be erected, in order to meet the greatly increased supply of electrical energy which will in all likelihood be required during the winter of 1911 or 1912. The chief points to be kept in view in selecting a site for a generating station are the following: (1) There should be suitable foundations for heavy machinery; (2) the site should be adjacent to a railway or canal, or be otherwise so situated, that a cheap supply of coal can be easily obtained; (3) there should be ample supply of water at hand for condensing purposes; and (4) the site should be within a reasonable distance of the area to be supplied. The conditions now indicated are not of equal importance, and it may be necessary to sacrifice the minor in order to obtain the more important of such conditions. This means that the committee should, if possible, secure a site in near proximity to the river Clyde, and with at least one railway system in its immediate neighbourhood. He suggests, accordingly, a site of 53,814 sq. yd. near Dalmarnock Road, with a frontage to the Clyde, and with the Caledonian Railway adjacent. The committee has approved of the report, and if the site proves suitable in every respect it intends to purchase the ground.

Some time ago a Special Committee appointed by the T.C. to arrange for an exhibition of appliances for heating, lighting and cooking by gas or electricity, reported to the Corporation that as suitable premises could not be obtained for the purpose, the proposed show should be postponed. Since then, however, further inquiries have been made, and an offer has been accepted for the lease of a hall at £100 a week for the exhibition, which will be held in September, and continue for at least a month. Mr. W. W. Lackie, the T.C. engineer, is looking after electrical interests.

Harrogate.—The T.C. is desirous of extending the lighting mains into the area of the R.D.C., just over the borough boundary, and has applied to the Rural Council for consent. This, however, has been withheld for the present, although the chairman of the Council strongly advocated consent being given, as many residents in the rural area had had to go to the expense of providing their own plant.

Haydock.—The B. of T. has informed the U.D.C. that consideration of the revocation of the E.L. order has been deferred for a year.

India.—A scheme is under consideration for obtaining electrical energy from the falls on the Bari Doab Canal in the Punjab, for driving the canal workshop machinery at Amaritsar, and for various pumping projects, some further particulars of which can be obtained from the B. of T. Commercial Intelligence Branch.

Japan.—By the last Japanese mail we learn that negotiations are in hand in connection with the formation of a second electric lighting company in the town of Kobe.

Maidstone.—The T.C. has adopted the following revised scale of charges for electrical energy:—Shops, licensed and business premises, 10s. per annum for each 32-watt lamp alight at one time, or a flat rate of 4d. per unit for old customers, and for new customers 10s. per annum, or a flat rate of 8d. per unit; private houses, 8s. per 32-watt lamp per annum, or 4d. per unit as at present.

Mexico.—Senor Manuel Tamborrel has been empowered by the Government to utilise the river Conchos (State of Chihuahua) for irrigation and power purposes.—*Board of Trade Journal.*

Radcliffe.—A B. of T. inquiry interesting many local authorities was opened at Radcliffe on Tuesday. The inquiry raises an important question covering municipal and private trading, and the result will decide whether the Council is to retain its monopoly powers for the supply of electricity in the township. The Lancashire Electric Power Co., which erected a generating station at Outwood, on the Radcliffe boundary, about six years ago, has made many efforts to supply in Radcliffe, but the Council declined to allow the company to enter into unrestricted competition with its own works. Recently the Power Co. applied to the B. of T. for a provisional order which, if granted, would enable it to enter into open competition with the District Council, and the inquiry which is being held relates to this application. The District Council's desire to keep out the company is not unanimously approved in the town, and a petition signed by local ratepayers in favour of the order being granted to the company has been presented at the inquiry. Mr. C. H. Pickstone, solicitor, opened the inquiry by stating the Power Co.'s position. He said that by its original Acts of Parliament, the company found itself unable to develop the concern. There was a large and increasing demand for electricity, which evidently no one was as well fitted to serve as the company, and consequently it sought increased powers and obtained them, but still found itself fettered. In the case of Radcliffe, the company could only supply electricity to persons with the consent of the Radcliffe Council, and it felt bound to go to Parliament for a provisional order to serve Radcliffe without the consent of the District Council. All the Power Co. had asked was an arrangement with the Council by which the Council would supply firms whom it could supply, and allow the company to supply the large firms which the Council could not supply, without the consent of the Council.

Rochdale.—The Corporation Electricity Committee has decided to recommend the T.C. to increase the salary of the electrical enginer (Mr. C. C. Atchison) by £50—that is, from £350 to £400. Mr. Atchison entered the Corporation's service at the electricity works in 1900 at a salary of £200. Large developments and extensions have since taken place, and it is held that the salary is below the standard, the average for such a town being £426.

St. Helens.—The Electricity Committee is applying for sanction to borrow £3,930 for the extension of the boiler house and plant and the supplying and fitting of mechanical stokers and elevators. The Commitee is rapidly extending the arrangements for supplying the works and collieries of the town and district with H.T. current, and is applying for a loan of £6,500 for a 1,000-KW. turbo-alternator, &c., to enable it to meet the increased demand.

Sherburn.—The public electric lighting installation has been completed, and is proving a complete success. Energy is supplied by the County of Durham E.L. Co.

Warrington.—The electrical engineer has submitted to his Committee a preliminary report on the tenders received for the 1,000-KW. turbo-alternator, rotary converter and switchgear. The Committee has decided to apply to the L.G.B. for sanction to borrow £7,420, the estimated cost of the above plant and the necessary building, platform, foundations, &c., thereof. £2,000 is to be contributed out of the profits of the tramway undertaking in relief of the rates for the ensuing year. Application is to be made to the B. of T. for a prov. order for the supply of electricity within the limits of supply for gas purposes outside the borough. The L.G.B. has sanctioned the borrowing of £500 for the provision of transformers in connection with the electricity undertaking.

Wednesbury.—An additional loan of £880 for meters, mains and services, has been applied for by the T.C.

Wilmslow.—The District Council on Monday evening decided to renew the agreement with the Alderley and Wilmslow Electric Supply Co. for the lighting of Wilmslow for another five years. The company undertakes to carry out improvements on the main roads. Extensions have been passed for other districts, and when those have been made nearly the whole of the long length of main road from Manchester to Alderley will be lighted.

Worcester.—The Electricity Committee of the T.C. has approved of the expenditure of £808 for the installation of electric lamps for lighting the tramway routes. The B. of T. has been asked to permit the provision of overhead mains for the scheme.

TRAMWAY and RAILWAY NOTES.

Australia.—It is proposed to construct a subway from Moore Street, Sydney, N.S.W., to Lavender Bay, for the purpose of affording railway communication between the city and North Shore. The estimated cost, exclusive of electric power, is given at £753,000, and that of electric power, rolling stock, &c., as £292,500, the total for the whole scheme being £1,045,500.—*British Australasian.*

Belfast.—Sir James Henderson, in presenting the report on the working of the tramway, said that he was informed by the manager that the receipts for the year ended 1909-10, were £203,865, as compared with £195,043 the previous year, or an increase of £8,813. The net profits showed an increase of between £9,000 and £10,000. A deputation from the Belfast Trades Council waited on the Council and put its views on the purchase of the Whitewell and Cavehill tramway line before the corporation. The deputation was informed that its views would receive attention. Subsequently the minutes having reference to the preparation of a draft agreement with the Cavehill and Whitewell Co. in regard to the purchase of that undertaking were passed.

Blackpool.—At the T.C. meeting on Tuesday, Ald. Brodie announced that the receipts from the tramways for the year ended last Thursday were £6,584 more than in the previous year, mainly due to having two Easters in the one financial year, as well as an aviation meeting. During the aviation week there was an increase of about £3,000 in the tramway receipts. It was understood that £5,000 was put to the reserve fund every year, and this year a similar amount would be put aside out of the profits, after paying £2,000 to the rates.

Bradford.—At a meeting of the Corporation Tramways Committee, on Monday, Ald. Priestley presiding, statistics were presented which showed that the revenue of the tramways for the year ended March 31st last was £259,728, compared with £244,234, an increase of £15,493, or 6·34 per cent. The car-mileage was 5,436,529, an increase of 60,301. The number of passengers carried was 50,518,816, an increase of 2,858,805. The route-mileage was 54·81, the same as in the previous year.

Canada.—H.M. Trade Commissioner reports that application is to be made to the Legislature of the Province of Quebec at its next session for an Act incorporating a company, under the name of the Montreal Underground and Elevated Railway, with a capital of about £4,111,000, empowered to construct and work by electricity or other motive power underground and elevated railways through the city and island of Montreal.—*Board of Trade Journal.*

Continental Notes.—BELGIUM.—The balance-sheet of the Société des Tramways Electriques de Gand for the last financial year shows a profit of £8,360, as contrasted with only £4,360 in the preceding 12 months.

Negotiations are in hand with reference to the conversion of the steam tramway between Blankenberghe and Heyst into an electric line.

TURKEY.—A concession has just been granted for the construction and working of an electric tramway in the town of Brussa. The line will have a length of about 5 miles.

FRANCE.—The Midi Railway Co., of France, is about to carry out a trial with an electric locomotive of 1,500 H.P., built by La Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont, France.

RUSSIA.—The City of Moscow is seeking to raise a loan of £2,635,000 for municipal objects, nearly half being for tramways.

The town of Tzaritzin has just contracted a loan of £159,375 for the purpose of tramway construction, electric lighting, &c.

Egypt.—The Compagnie Générale de Railways et d'Electricité, of Brussels, in the course of the annual report for 1909, announces that the construction of the metropolitan railway of the Cairo Electric Railways and Heliopolis Oases Co. is almost entirely completed, and the rolling stock is being erected in the company's shops at Heliopolis. The power station, which is of 10,000 H.P., is situated on the Nile at Choubrah, where the engineers are testing the turbines and alternators, whilst the cables of the high-pressure line from the station to Heliopolis are already erected. It is intended to inaugurate the railway, which is about 5 miles long, at the beginning of May, when the journey between Heliopolis and Cairo will be accomplished in ten minutes.

Japan.—A scheme is at present under consideration for the construction of an electric railway between Hachoiji and Shinjuku, near Tokio. The projected line would be about 20 miles long, and would be connected with the Tokio Railway.

Leeds.—For the year just ended the receipts of the Corporation tramways have been the largest ever recorded, being £15,609 more than in the previous year, with a total of £357,610, as compared with £342,000 in 1909. The passengers carried were 78,385,015, an increase of 2,169 397; the car-mileage run was 8,152,990, an increase of 324,196, and the receipts were 10 52d., against 10 47d. per car-mile. It was estimated that the profits available for relief of the rates would be £46,000, but it is probable that at least £6,000 more than this sum will be available. The average fare paid per passenger was 1·083d., against 1 064d. in the previous year.

Llandudno.—The efforts of the Council to purchase the undertaking of the Great Orme Tramway Co. have so far not met with much success. After negotiations had proceeded for some time, it was decided to hold a special meeting to make an offer of £7,500 for the concern. The directors of the company had, however, reckoned without the shareholders, who at the annual meeting recently, passed a resolution instructing the directors to break off all negotiations for the sale of the concern. The Council was not officially informed of this change in the circumstances, and the meeting was duly held, but only six members attended, and the meeting was adjourned *sine die*.

London.—According to the *Standard*, tenders have been submitted for the extension of the Central London tube from the Mansion House to Liverpool Street. The new line (which will cost some £300,000) will run under Old and New Broad Streets and the Metropolitan Railway to a terminus under Liverpool Street. Lifts will communicate with the circulating area at Liverpool Street Station and with Broad Street Station, and at the latter there will be a street entrance and booking hall.

Mansfield.—An extension of time of one year for constructing and completing works under the Mansfield and District Light Railways (Extensions) Order, 1907, has been applied for by the Light Railway Co.

Oldham.—The traffic receipts on the tramways during the four days ended March 25th to the end of the financial year were £855, making a total for the year of £91,794, compared with £99,085 for the previous year, a decrease of £7,291. Taking the three days of the new year up to and including March 27th, the receipts were £1,155, compared with £1,070 for the four days ended March 28th, 1909. The increase of £85 with a day less to reckon this year being accounted for by the Easter holiday.

Rochdale.—The gross receipts on the Corporation tramways for the year just ended were £54,069, an increase of £410 on last year. There had been 9,966,162 passengers carried compared with 9,983,687 in the previous year, when the gross takings were £53,669.

South Shields.—The financial summary for the Corporation tramways for the year ended March 31st last, has just been issued, and shows that the traffic receipts totalled £29,052, an increase of £344, as compared with the previous year, the average per car-mile being 8·64d., as against 8·49d. last year. The undertaking has benefited during the year by a considerable reduction in the bill for electric current and the fact that the year included two Easters, and it is expected that the previous year's profits will be increased by about £1,000.

Stourbridge.—The U.D.C. has decided to lodge with the B. of T. objections to the proposed transfer from the B.E.T. Co. to the Dudley, Stourbridge and District Electric Traction Co., Ltd., of certain parts of the undertaking authorised by the Dudley and District Light Railways (Extensions) Orders, 1900.

TELEGRAPH and TELEPHONE NOTES.

Cables Interrupted and Repaired.—Corfu-Zante interrupted 29th, repaired March 31st, 1910; Dakar-Conakry, interrupted March 31st, 1910.

Cable Rates.—A Bill to bring the rates charged by ocean cable companies under the control of the Railway Commission has been passed by the Canadian House of Commons, the object being ultimately to compel the companies to accept deferred telegrams at 6d. per word, and Press messages at 3d. per word, while charging 1s. per word for urgent telegrams, as at present. No effect can be given to the proceeding without the passing of a similar Act by the British Parliament, which is not a probable event, at present.

Japan.—So great is the demand for the telephone in Japan, that the Department of Communications is said to be just now unable to meet promptly all the demands for installations, over 3,000 of which have been carried out by the Department during the past few months.

Long-Distance Telephony.—The Ltd. Co. "Telefon," with the object of promoting the Egnér—Holmström long-distance telephone patent, has been formed with a minimum capital stock of 500,000 kr.; the maximum capital is not to exceed 1,500,000 kr. The L.M. Ericsson Co. has secured the right of using the patent for telephoning by wire in all countries except Sweden, United States and Germany. Regarding Sweden, the State Telegraph Department has bought the patent rights.

Recently the Royal Castle at Stockholm and the Grand Ducal Castle at Karlsruhe were connected up, and the King and Queen of Sweden spoke with the Grand Duke and Duchess. Every word was clearly heard. Regular long-distance telephone connections by the new system are in course of being set up between Stockholm and Copenhagen, Hamburg, Berlin and Paris.

Postal Telegraph Clerks' Conference.—The annual conference of the Postal Telegraph Clerks' Association was held at Sheffield last week. Resolutions were passed regretting the withholding of civil rights from Civil Servants in connection with Parliamentary elections, and urging that the time had come for cheapening telegraphic communication. On Saturday evening the annual dinner was held.

Telegraph Convention.—The German South American Telegraph Co. has notified its adherence to the International Telegraph Convention of St. Petersburg.

Telegraphists' Cramp.—A Departmental Committee has been appointed by the Postmaster-General to inquire into the prevalence and causes of the disease known as the "telegraphists' cramp," and to report upon means for its prevention.

Venezuela.—The French Telegraph Co. has ceded to the Government of Venezuela seven coastal cables, extending from La Guayra to Carupano and Puerto Cabello, and from La Vela de Coro to Maracaibo; while the St. Louis-Dakar cable has become the property of the French Government.—*Journal Télégraphique.*

Wheatstone in Australia.—Steps are being taken by the Commonwealth Government towards the general use of Wheatstone automatic repeaters for the transmission of interstate traffic. The system is already in use between Sydney and Brisbane and Adelaide, and has rendered most valuable service. A conference has recently been held of the electrical engineers of the telegraphic department on the question of improving communication between the various States.

Wireless Telegraphy.—According to the *Sydney Morning Herald*, Mr. J. H. Pike, a private experimenter at Arncliffe, Sydney, with apparatus of his own construction, has succeeded in receiving messages emanating from H.M.S. *Powerful*, at Auckland, New Zealand. This is stated to be the first time that wireless signals from New Zealand have been received in Australia.

The experiments carried out by the German Government with a view to establishing direct communication with the German Cameroons, have been very successful. Communication between the Telefunken Co.'s station at Nauen, and a ship of the Woermann Line, was maintained all the way from Hamburg to the Cameroons, the distance covered being 6,600 kilometres (4,125 miles). Presumably the communication was one way only—from Nauen to the ship.

The Australian Mining Standard and Electrical Record gives publicity to a series of "facts" regarding a system of wireless telegraphy invented by a Mr. Victor Nightingall, which, to our mind, appear somewhat hypothetical. It is stated that radium is used in the receiving apparatus, increasing the sensitiveness of the latter, so that messages can be sent with the expenditure of 15 per cent. less power. "Working on shipboard, by means of a small generator, the Nightingall apparatus launches messages about 700 to 1 000 miles into space." Many singular claims are made for the system, which suggest confusion between power expended and frequency or wave-length employed. "The instrument, for marine purposes, is no larger than a ship's binnacle." "Replies come telephonically, as well as being indicated on the instrument, in such a way that any unskilled person can read them." "There is no call for the employment of an operator, as anyone can work it." Much as we regret to run counter to our respected contemporary, we feel bound to express the opinion that practically all these statements, with others in the article, have no foundation more substantial than that of the inventor's optimistic aspirations.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 3rd. Sulphate of copper, for the P.M.G.'s Dept. in all States. Tender forms, &c., may be obtained at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

QUEENSLAND.—June 8th. Six sections of common battery switchboard and equipment, jumper wire, and cable, for the P.M.G.'s Dept. Tender forms, &c., at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

May 17th.—1,010 reinforced concrete telegraph poles, for the P.M.G.'s Department, Victoria. Forms, &c., at the Commonwealth Offices, London. See "Official Notices" April 1st.

May 18th.—Paper-insulated, lead-covered, and brass ribbon-tape cable, for the P.M.G.'s Department, Queensland. Forms, &c., at the Commonwealth Offices, London. See "Official Notices" April 1st.

Austria.—April 18th. The Austrian State Railway authorities in Linz are inviting tenders for the establishment of a small central electric lighting station at the railway station at St. Valentin.

Austria-Hungary.—June 6th. Tenders are invited by the Municipality of Pécs for the building and working of an electric railway in that town. See a notice in this column last week.

Belgium.—April 13th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the contract for the overhead electrical equipment of the Sart-Housy section of the Spa-Verviers electric railway.

The municipal authorities of Ixelles, near Brussels, have just invited tenders for the supply and erection of 50 arc lamps.

Chorlton.—April 11th. Wiring, &c., for E.L. at the "Ins and Outs" Homes, Cavendish Road, West Didsbury, for Chorlton B.G. Chas. Clegg & Sons, architects, 21, Spring Gardens, Manchester (returnable deposit, 10s.).

Colwyn Bay.—April 9th. Stores for the U.D.C. Electricity Department. See "Official Notices" March 18th.

Dartford.—April 20th. One feeder pillar and 1,350 yd. of paper-insulated and lead-covered cable, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Dover.—April 16th. An electric jib crane for the Harbour Board. Mr. Martyn Mowll, Register, Harbour Board, Castle Street, Dover.

Glasgow.—Cables for Yorkshire Quays. Engineer, Clyde Navigation Trust, Robertson Street.

Grimsby.—April 18th. Three-wire balancer and two years' supply of D.C. motor meters, for the Corporation Electricity Department. See "Official Notices" to-day.

Halifax.—April 18th. One 300-KW. rotary converter, transformers and switchboards, for the Corporation. See "Official Notices" to-day.

Littleborough.—May 2nd. H.T. feeder cables, L.T. distributors, &c., and transformer kiosk, transformers, equipment, switchgear, &c., for the U.D.C. See "Official Notices" April 1st.

London.—L.C.C.—April 20th. Wiring and fitting for electric lighting at Shelburne Road and Torriano Avenue Schools. See "Official Notices" April 1st.

Manchester.—April 22nd. Five 600-KW. motor-converters or rotary converters and static transformers, for the Corporation Electricity Committee. See "Official Notices" to-day.

Monte Video.—July 4th. Twenty electric cranes for the Harbour Authorities. Plans and specifications at the Secretary's Office of the Consejo de Administracion del Puerto de Monte Video. Tenders to the Consejo.—*Board of Trade Journal.*

Nuneaton.—April 25th. Water-tube boiler, feed-pump, pipework, valves, &c., for the Borough Electricity Department. See "Official Notices" to-day.

Pontypridd.—April 11th. Tramwaymen's uniforms, for the U.D.C. See "Official Notices" April 1st.

St. Petersburg.—The Central Telephone Administration of St. Petersburg has secured permission from the municipal authorities to apply a sum of 2,835,000 roubles (about £300,000) for the purpose of extending the telephone system and enlarging the central exchange so as eventually to supply 34,000 subscribers. The Administration is now desirous of providing arrangements for an eventual 45,000 subscribers, and has accordingly asked that the amount be increased to 4,846,000 roubles (about £510,000).—*Board of Trade Journal.*

Spain.—April 15th. The municipal authorities of Almaden are inviting tenders for the concession for the electric lighting of the town during a period of 10 years. Particulars can be obtained from, and tenders are to be sent to, the Secretariat del Ayuntamiento de Almaden.

Wallasey.—April 18th. Stores for the U.D.C. Electricity Department. See "Official Notices" March 18th.

Walthamstow.—April 22nd. One feeder booster set, and switchboard and accessories. See "Official Notices" April 1st.

Whitwood.—April 28th. Materials in connection with the proposed electricity supply, for the U.D.C. See "Official Notices" to-day.

CLOSED.

Australia.—The tender of the Australian Wireless Telegraph Co. for the construction of wireless telegraph installations at Fremantle and Sydney, at £8,300, has been accepted.

Barrow.—The Electricity Department has accepted tenders for stores, &c., as follows:—

Tinned copper wire.—W. T. Glover & Co., Ltd.
Varnish, switches and various.—Ward & Goldstone.
Insulating compound.—A. Duckham & Co.
Arc lamp carbons.—W. Geipel & Co.
Arc lamp globes, shades, &c.—City Glass Co.
Joint boxes and cut-outs.—British Insulated and Helsby Cables, Ltd.
Meters.—Chamberlain & Hookham and Reason Manufacturing Co.
Various lamps.—Drake & Gorham, Ltd., and British Thomson-Houston Co.
Pipes and troughing.—Doulton & Co., Ltd.
Refined tar.—R. S. Clare & Co., Ltd.
Meter boards.—J. Nicholls.
Brass saddles and pins.—General Electric Co., Ltd.

Belfast.—At the meeting of the Corporation on 1st inst. Messrs. Willans & Robinson's tender, at £10,172, for the supply of a turbo-dynamo and condensing plant was approved subject to the Corporation having the option to purchase a duplicate plant within 12 months, for £8,433.

Belgium.—Ten concerns—eight German and one each French and British—submitted tenders to the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for the supply and laying of the armoured underground cables required for the electric railways in the Centre district. The prices submitted were for cables of aluminium or alternatively of copper. The lowest tender for the former was that of the Ateliers de Constructions Electriques du Nord et de l'Est, of Paris, and for the latter that of Callender's Cable Co., Ltd., London.

Canada.—According to the *Canadian Engineer*, the Water Commissioners of London, Ontario, have lately placed electrical contracts to the value of $50,556 as follows:—

Canadian General Electric Co.	$25,745
Canadian Westinghouse Co.	$24,811

For three-core cable required in connection with the Toronto Hydro-Electric system, the tender of the Canadian British Insulated Co., Ltd., of Montreal, has been accepted.

Eastbourne.—The T.C. has accepted the tender of Harrison, Son & Jobson, at £131, for the pipework required for the first section of the extension of the water-cooling plant for the new condenser.

Eccles.—The T.C. has accepted the tender of Messrs. N. Brookes & Son, of Patricroft, for extensions to the electricity works, at £750.

Glasgow.—Messrs. Siemens Bros. have secured the contract at a total price of £6,442 for the provision of an additional generating set of the Rothesay Dock of the Clyde Navigation Trust.

Grimsby.—The T.C. has accepted the tender of the Jandus Arc Lamp & Electrical Co., Ltd., for 80 flame arc lamps with spares, &c., for £561, provided that the company will give a two years' guarantee as to the working of the lamps.

Leyton.—The U.D.C. has provisionally accepted the tender of Messrs. S. Hammond & Co., at £115, for the installation of telephones at the public offices extension.

London.—SHOREDITCH.—The Lighting Committee has recommended the tender of Messrs. Evered & Co. (£207) for an additional feeder panel for Whiston Street station.

MARYLEBONE.—The B.C. has accepted the following tenders for annual supplies:—

Lucy & Co.—Cut-outs (the firm whose tender was previously accepted having withdrawn).
Le Carbone, Ltd.—Carbon brushes.
British Electric Trade Supply and Bitumen Co.—Bitumen, £14 per ton.

The Council has further accepted the tender of Messrs. Babcock and Wilcox for two internal superheaters, at £500.

Newport (Mon.).—The tender of Messrs. A. G. Arnold and Son, of Newport, for the electric light installation at the new Technical Institute, at £1,448, has been accepted by the Committee.

Northampton.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for two tramcars, at £555 each.

Ramsgate.—The T.C. has accepted the tender of Messrs. Vitty & Hopper, of Ramsgate, for the execution of E.L. work at the Pavilion, at £110.

Salford.—The T.C. has accepted the following tenders for two years' supply of the undermentioned articles:—

Special car accessories.—Tramway Supplies, Ltd.
Car accessories, electrical.—J. Hall, Liverpool Electric Cable Co., Manchester Armature Repair Co., British Westinghouse Co., British Thomson-Houston Co., General Electric Co., L. Andrew & Co.
Overhead equipment materials.—G. Hill & Co., Watlington & Co., British Insulated and Helsby Cables, Tramway Supplies, Ltd., H. E. Buck and Co.
Ears, frogs, pull-offs, &c.—G. Hill & Co., Tramway Supplies, Ltd., E. Dewhurst, British Insulated and Helsby Cables, Watlington & Co.

The following are for annual supplies:—

Cable protectors and cable bearers.—Albion Clay Co., Ltd.
Maximum-demand indicators.—Reason Manufacturing Co., Ltd.
Wood troughing, casing, and capping cleats for meter boards.—C. Jennings and Co.
Ammeters.—Eckstein, Heap & Co.
Arc lamp globes.—City Glass Co.
Glow lamps.—General Electric Co., Ltd.
Carbon brushes.—H. G. Mayer & Co.
Arc lamp carbons.—Crompton & Co., Ltd.
Meter boards and blocks, starter boards and wood cable-bearers.—J. Wheeldon & Sons.
Sight feed glasses, india-rubber rings.—Tomey & Sons.
Cables.—W. T. Glover & Co., Ltd.
Meters.—Ferranti, Ltd.: Chamberlain & Hookham, Ltd.; General Electric Co., Ltd.; British Westinghouse Co., Ltd. (trial order).
Motor starters.—Veritys, Ltd.

They have also accepted the tender of Mather & Platt, Ltd., for repairs to the No. 6 dynamo, £150.

Watford.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for cables for a year; that of Babcock & Wilcox, Ltd., for close pattern links for the chain grate stokers, at £66; and that of Lassen & Hjort for a standard filter and a 2,000-gal. storage tank, at £82.

Wimbledon.—The T.C. has accepted the following tenders for annual supplies to the electricity undertaking:—

Cables and pilot wires.—Western Electric Co., Ltd.
Conduits.—Albion Clay Co., Ltd., and Doulton & Co.
Joint boxes and jointing materials: compounds and tapes.—Siemens Bros. & Co., Ltd.
Fuse boxes.—British Insulated and Helsby Cables, Ltd.
House-service boxes.—W. Lucy & Co., Ltd.
Frames and covers.—Callender's Cable and Construction Co., Ltd.
All other items in schedule.—W. Lucy & Co., Ltd.
Transformers.—British Westinghouse Co.
Meters.—Ferranti, Ltd.
Oils.—Duckham & Co., Ltd.
Carbon and metal lamps.—General Electric Co., Ltd.
V.I.R. cables.—Siemens Bros. & Co., Ltd.
Arc lamp globes.—E. J. Shaw & Co.
Flame arc lamp carbons.—Union Electric Co., Ltd.

The Council has further accepted the tender of Babcock & Wilcox, Ltd., to supply and fix pipework for the new horizontal "Curtis" turbine to be installed, at £340; also the tender of S. R. Love and Son to wire, for lighting and power purposes, the new refuse destructor, at £63.

FORTHCOMING EVENTS.

Physical Society.—Friday, April 8th. At 2 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "An Experimental Demonstration of the Loading of Artificial Telephone Cables," by Mr. B. S. Cohen.

Association of Engineers-in-Charge.—Saturday, April 9th. At 6.30 p.m. At the Holborn Restaurant. Annual dinner.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 9th. At 2 p.m. At the Wood Memorial Hall, Newcastle. Papers on "The Ignition of Coal-Dust by Single Electric Flashes," by Messrs. W. M. Thornton and E. Bowden; "Electrification at Murton Colliery, Co. Durham," by Mr. E. S. Wood; and "Electricity at Shamrock I and II Colliery, Herne, Westphalia, Germany," by Mr. H. M. Hudspeth.

National Electrical Manufacturers' Association.—Tuesday, April 12th. At 2.30 p.m. At Balfour House, E.C. Committee meeting.

Junior Institution of Engineers.—Tuesday, April 12th. At 7.30 p.m. At the Royal United Service Institution. Paper on "High-Speed Steam Turbine Rotor Design and Construction," by Mr. J. M. Newton.

Institution of Electrical Engineers (London Students' Section).—Wednesday, April 13th. At 7.45 p.m. At 99, Victoria Street, S.W. Paper on "The Theory and Design of Current Transformers," by Mr. A. P. Young.

Association of Engineers-in-Charge.—Wednesday, April 13th. At 8 p.m. At St. Bride's Institute, E.C. Paper on "Welding and its Application," by Mr. R. J. Wallis-Jones.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are announced:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, April 11th.—"A" Company. Technical drill, 7 to 9.30 p.m.
Tuesday, April 12th.—"B" Company. Infantry drill, 7 to 8 p.m.; technical drill, 8 to 10 p.m.
Wednesday, April 13th.—Gymnasium, 6 to 9.30 p.m.
Thursday, April 14th.—"C" Company. Recruits' infantry drill, 6.30 to 7 p.m.; technical drill, 7 to 9.30 p.m.
Friday, April 15th.—"D" Company. Recruits' infantry drill, 6.30 to 7 p.m.; technical drill, 7.15 to 9.30 p.m.

(Signed) P. H. Campbell, Capt. R.E., Adjutant,
For C.O. E.E., L.D.

THE BENEVOLENT FUND BALANCE-SHEET.

At the annual general meeting of the Electrical Trades Benevolent Institution held on Wednesday at the Hotel Cecil, the following balance-sheet to December 31st, 1909, duly audited, was submitted:—

Receipts.

To Balance in hand			£129 16 6
„ Dividend on investments	62 19 5		
„ Subscriptions	102 9 9		
„ Donations...	584 4 6		
		749 13 8	
„ Manchester Electrical Exhibition		364 19 3	
		£1,244 9 5	

Expenditure.

By Grants made: A £15, B £5, C £13, D £13, E £5 ...		£51 0 0
„ Printing, postage, petty cash and cost of meetings		92 0 8
„ Secretary's salary, 1908	£25 0 0	
„ „ 1909	25 0 0	
		50 0 0
„ Investment £1,000 Cape of Good Hope 3½ per cent. stock		987 17 0
„ Balance of cash in hand at bank		63 11 9
		£1,244 9 5

Assets

Previously invested £1,100 Victoria 3½ per cent., cost	£1,101 11 0
Invested in 1909, £1,000 Cape of Good Hope 3½ per cent., cost	987 17 0
Cash in hand and at bank	63 11 9
	£2,152 19 9

At the annual meeting on Wednesday a fair number of supporters were present. Mr. W. B. Esson presided, in the absence of Mr. E. Garcke, who was to have been in the chair, and after the minutes of the last general meeting had been duly read and approved, the secretary, Mr. Walter Davenport, read the report for the year 1909 which in a general sense showed a steady progress during the 12 months. This was put to the meeting and duly carried, after which Mr. Eck, who has taken a very prominent interest in the affairs of the Institution, made a few remarks bearing on the subjects mentioned in the report. He alluded to the applications for assistance which had been submitted to the Committee, stating that all of them had been fully settled, and he stated to all our satisfaction that the applicants were now doing fairly well in various positions. A vote of thanks to Dr. Kapp for having presided at the last festival dinner was proposed by Mr. F. H. Nalder, and, needless to say, it was carried with acclamation, after which the election of the Committee was proceeded with. The following members retired in accordance with Rule 3, viz., Messrs. Grainger, Johnson, Lundberg, Nalder, Northcote and Oppenheimer, all of whom were duly re-elected, after which it was proposed by Mr. Rich and seconded by Mr. Rentell, that the name of Mr. F. B. O. Hawes be added to the list, as he was prominently connected with the electrical industry. Other names proposed and duly approved of were: Mr. B. Longbottom (Electromotors, Ltd.), and Mr. S. D. White (General Electric Co., Ltd.). Messrs. Henley Smith & Son were unanimously re-elected auditors. A letter was read from Sir Wm. Preece expressing his inability to be present owing to his absence in Wales, and the meeting closed with a vote of thanks to Mr. Eck for the work which he had so heartily given in promoting the welfare of the Institution, and to Mr. Esson for presiding at the gathering.

NOTES.

Indian Notes.—One of our Indian correspondents writes as follows:—

Calcutta.—The street-lighting question has again come up before the Municipal Council, and a local consulting engineer has offered to draw up a scheme for their approval. Much talk and pother has taken place over this lighting scheme, but nothing practical has yet been done beyond giving a big fee to a gas expert for his opinion and services For the second city of the British Empire, Calcutta cannot boast of a good system of lighting; some of its chief streets are wretchedly illuminated.

The Calcutta Electric Supply Co. has had a very successful year all round, with its load increasing steadily from year to year, and in the hands of capable management it is in a flourishing condition. That no stoppages or breakdowns of any kind have taken place during the past year is satisfactory evidence that the new chief engineer, Mr. Winkfield, is the right man for his important position, and that he has been supported by a staff of capable subordinates.

Lucknow Municipality.—At a meeting held recently several proposals for electric supply were considered. These differed so largely both in systems recommended and in total cost, that the authorities have decided to engage the services of a consulting engineer to draw up a suitable scheme, and to call for tenders.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (DUBLIN LOCAL SECTION).—An enjoyable social reunion of the members of the Dublin Section was held in the Lecture Theatre of the Royal Dublin Society on March 26th. A large number of guests accepted the invitation of the chairman (Prof. W. Brown, B.Sc.) and the Committee. A varied programme had been arranged by Mr. George Prescott, and X-ray demonstrations were given from time to time by Mr. H. H Poole, B.A. Mrs. M'Carthy Judd conducted a number of interesting exhibitions of cooking by electricity, and workers from the Mespil Laundry, with electrically-heated irons, demonstrated the utility of electricity in this branch of industry. The guests numbered nearly 300.

SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.—At the first ordinary general meeting of this new Institute, held at Johannesburg on January 13th, the president (Mr. C. W. R. Campbell) delivered his inaugural address on the subject of the mutual dependence of engineers in all branches upon one another, which is printed in Part 2 of the *Transactions*, together with the welcome accorded by members of other engineering Associations to the new body.

MANCHESTER ASSOCIATION OF ENGINEERS.—On Saturday last Mr. A. Etchells read a paper on "Hydraulic Machinery and Appliances," in the course of which he expressed the opinion that electro-hydraulic machinery would come into more general use, electric power being transmitted to the machine and there converted into hydraulic power. This system was both economical and convenient, each machine working at the pressure most suitable for its purpose.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—On March 21st a paper was read by Dr. J. Morrow on "A Heat Diagram for Use in Turbine Design."

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND.—A paper was read on March 22nd by Mr. C. F. A. Fyfe, describing some tests which he had carried out on board ship to ascertain the water consumption of engine-room and deck auxiliaries.

INSTITUTE OF METALS.—The Council has decided to initiate an annual series of May lectures, the first of which will take place in London on Tuesday, May 24th, when Prof. Gowland, F.R.S., vice-president of the Institute, will deliver a lecture on "The Art of Working Metals in Japan." Previous to this lecture there will be a ballot for the election of new members; applications for membership should be forwarded before April 27th next. There will be no other opportunity of obtaining admission to the Institute until the autumn meeting.

Parliamentary.—TELEGRAPH CONSTRUCTION ACT.—In Tuesday's Parliamentary Papers, Sir John Rolleston asked the Postmaster-General if, under The Telegraph Construction Act, 1908, the Post Office, failing agreement, could compulsorily break up live hedges growing on the freehold of a landowner and place telegraph poles therein without any compensation for damage or without payment for the use of the land. Mr. Herbert Samuel replied that under the Telegraph Construction Act, 1908, the Post Office, failing agreement with the landowner, can appeal to a stipendiary magistrate or County Court, and can, if dissatisfied, further appeal to the Railway Commissioners for power to construct a telegraph line over, along, or across a hedge, bank, or land within 20 ft. of the road, and, if such power is granted, can proceed with the work. The landowner has an equal right of appeal to the Railway Commissioners. The Court to which the appeal is made can impose payment for the use of the land. Compensation for damage done in the exercise of the powers conferred by the Telegraph Acts is provided for by the Act of 1863

TELEPHONE EXCHANGES.—Mr. Perkins asked the Postmaster-General whether he was aware that telephone exchanges had been promised by his Department since June, 1908, at both Lyndhurst and Brockenhurst, Hants.; what was the reason for these delays, and when did his Department propose to complete them. Mr. Herbert Samuel, in answer, remarked that the Department were anxious not to interfere with the amenities of the New Forest, and the delay had been occasioned by the extreme difficulty of arranging to lay the telephone wires so as to avoid this. His officers were in communication with the Woods and Forests Department, and every effort would be made to reach a satisfactory settlement.

DANGER TO TRANS-ATLANTIC CABLES.—Mr. Boland inquired of the Postmaster-General whether he was aware that, in spite of representations which had been made, considerable damage was being caused to the trans-Atlantic cables by the operations of steam trawlers off Ballins Kelligs Bay, and whether in view of the fact that a number of cables had had to be renewed, and that it was now proposed to lay two new cables, he could state what steps would be taken to prevent damage in the future. Capt. Norton replied that the most recent case brought to his notice of damage to a trans-Atlantic cable attributable to the operation of steam trawlers occurred in November last. An Inter-Departmental Committee considered this question in the summer of 1908, and reported in favour of a system of inspection of trawling gear as the most practical means of minimising such damage. Such a system of inspection was now in force at the ports concerned throughout the United Kingdom.

Burst Steam Pipe.—Three men were injured last week by the bursting of a steam pipe at the works of the Gutta-Percha Co. in Wharf Road, City Road, N.

Appointment Vacant.—Engine drivers, for the Carlisle Corporation Electricity Station (32s. 6d.). See our advertisement pages to-day.

The Japan-British Exhibition.—It is stated that H.I.H. Prince Sadanaru Fushimi, who is travelling from Japan with his suite on the North German Lloyd ss. *Kloist* in order to visit the Japan-British Exhibition in his official capacity as Honorary President of the Imperial Japanese Commission, will arrive on May 3rd at Genoa, where the party will land *en route* for London. H.I.H. has travelled abroad a good deal. In 1885 he made an extended tour in the United States. England, France, Germany, and other countries. In 1896 he went to Russia to attend the coronation ceremony, returned to the United States in 1904, and paid a memorable visit to the Court of St. James in 1907 on behalf of his Majesty the Emperor of Japan. Although not in the Prince's suite, Baron Oura, Japanese Minister of the Department of Agriculture and Commerce, and ex-officio President of the Imperial Japanese Commission to the Exhibition, is expected by the same steamer, in order also to pay an official visit to the Exhibition at Shepherd's Bush.

The L.C.C. intends to make a magnificent display at the Exhibition, occupying some 4,000 sq. ft.

Prices of Rubber Goods Advance.—Just as we go to press Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W., inform us that they are compelled further to increase the prices of their india-rubber tapes and solution, as from to-day.

The General Electric Co., Ltd., also announce that their prices for all rubber-covered wires, cables, flexibles and materials containing rubber were advanced on April 1st by 20 per cent. In effect this advance represents a further advance of 10 per cent. only, as the firm's prices for such materials were already subject to a 10 per cent. advance prior to April 1st.

The Science Museum.—Mr Walter Runciman, President of the Board of Education, has appointed a Departmental Committee to consider and report upon various questions in regard to the present condition and the future development of the valuable collections comprised in the Board's Science Museum at South Kensington and Geological Museum in Jermyn Street.

Salvage Magnet.—An electro-magnet has been built for the United States Steel Co. for rescuing iron cargoes from the bed of the Mississippi River. It has been employed for raising a barge-load of kegged nails; at each lift five or six kegs, each weighing 200 lb., were raised intact from a depth of 70 ft. A load of steel strips used in fastening cotton bales and a load of woven wire will be similarly rescued.

A New Type of Central Station Specialist.—Not a few of the smaller companies have found the work of power solicitation difficult and perhaps costly; the maintenance of one or two high-salaried employés giving their whole time to power solicitation has not always produced the results hoped for, especially in the face of local limitations of market and prejudices; and many times the most painstaking efforts to obtain and keep motor service have fallen short through the absence of a broad knowledge of power economics in the soliciting staff. Of course, in numerous other instances, power solicitation by small companies has been crowned with the most successful results. Out of the incompleteness and obstacles which have occupied the stage in many cases, however, has come an economic demand for a new type of central station specialist, who can give a number of co-operating companies the benefit of his experience, take command of difficult situations with a fair prospect of success, and point out wherein progress can be made in the handling of established and anticipated customers' power situations. In one case a start has been made in this direction with the prospect of decided gains in the power earnings and profits of the companies which are availing themselves of specialised advice. To a certain extent the work naturally follows that of the consulting electrical engineer making a speciality of industrial power problems, but it has this point of interest to the central station—the specialist in power service retained by one or more companies in the same general district makes a particular point of securing this business for the public utility corporations which employ him, and on the basis of a much wider experience than an ordinary company can afford to pay for in the form of a regular employé earning a relatively high income. That is, several companies, the number being immaterial, may combine to secure the supervision of the power specialist in connection with their new business departments. The power specialist is retained for a moderate yearly sum per company, he maintains a general oversight and correspondence with his clients on the basis of this fee, and when his presence is demanded by difficult conditions or other factors, he visits the client at a per diem rate lower than many outside firms of engineers would charge. In the instance in mind, the companies have received the benefits of broad experience in the handling of existing installations; established customers' plants have been improved in efficiency from 20 to 30 per cent.; the solicitation of new business has been brought under the eyes of technical ability derived from many years of actual contact with the immediate problems of small motor applications in industrial plants; the making of contracts has been placed upon a standard basis; guaranteed results have been placed in front of the prospective consumer; the influence of the power load upon the economy of production at the power station itself has been recognised; and the client organisations have availed themselves of a source of data covering a wide variety of industrial applications much of the material being hitherto inaccessible to single companies. Experience is showing more and more that the securing and retention of power business must be handled upon an engineering basis.—*American Electrical Review and Western Electrician.*

The M.E.A. Convention.—Last week we alluded briefly to the subjects that were to come before the fifteenth annual Convention of the Incorporated Municipal Electrical Association which is to be held between June 14th and 17th at Glasgow and Edinburgh. We now give fuller particulars from the preliminary programme received from the secretary, Mr. McArthur Butler:—

Tuesday, June 14th, Glasgow.

Convention to be opened by Lord Provost. Presidential address by Mr. W. W. Lackie. Paper and discussion:—"Commercial Progress," by Messrs. A. C. Cramb and H. Collings Bishop. Visits to Springburn sub station, Pinkston Power Station and Port Dundas Electricity Works.

Wednesday, June 15th, Edinburgh.

Welcome by Lord Provost. Papers:—"Mixed Pressure Turbines," by Mr. A. Bremner; "Exhaust Steam Turbines," by Mr. F. A. Newington; "Chemistry in the Boiler House," by Mr. A. R. Sillar. Visits to electricity works.

Thurday, June 16th, Glasgow.

Discussions:—"Advantages of Continuous Records of Costs and of Steam Consumption"; "Cheapening of the Cost of Mains and Services." Visits to St. Andrew's Cross Electricity Works, Coplawhill Works of the Tramways Department and the Govan Electricity Works; alternative series of visits to Partick Electricity Works, Clyde Valley Co.'s power station at Yoker and the shipbuilding works of Beardmore, Ltd., Dalmuir. Annual dinner at Windsor Hotel at 7.30 p.m.

Friday, June 17th, Glasgow.

Business meeting and a sail on the Clyde.

The headquarters during the visit will be the Windsor Hotel. The Glasgow meetings will be held at the Institute of Engineers and Shipbuilders in Scotland, Elmbank Crescent. At Edinburgh, Freemasons' Hall, 96, George Street, will be the meeting place.

A number of other works will be open for inspection by members notifying such a desire to the secretary:—Mavor & Coulson, Glasgow; Babcock & Wilcox, Renfrew; Craigpark Electric Cable Co., Glasgow; Greenock Electricity Works; Paisley Electricity Works; and Bruce Peebles, Edinburgh. The preliminary programme gives a list of suggested arrangements for the ladies accompanying the party.

Summer Meeting of Mechanical Engineers.—We are now officially informed that the joint meeting of the American Society of Mechanical Engineers with the Institution of Mechanical Engineers, which will form the Summer Meeting this year, will be held in Birmingham and London, and will begin on Monday, July 25th. According to the provisional Birmingham programme, on Tuesday, July 26th, the Lord Mayor of Birmingham and the members of the Local Committee will receive and welcome the President, Mr. George Westinghouse, and the officers and members of the American Society of Mechanical Engineers, and the President, Mr. John A. F. Aspinall, and the Council and members of the Institution of Mechanical Engineers. The reading and discussion of papers will then be proceeded with, and, after luncheon in the Town Hall, visits will be paid to Stratford-on-Avon, Worcester, Gloucester or Bournville, and local works. In the evening there will be a garden fête. On Wednesday, July 27th, there will be reading and discussion of papers, luncheon in the Town Hall, visits to the University and local works, and in the evening a reception by the Lord Mayor of Birmingham. Thursday, July 28th, will be devoted to visits to works in Coventry and Rugby; also to Warwick, Leamington, Kenilworth or Lichfield. Following these meetings the members of the American Society of Mechanical Engineers will be entertained in London. On Thursday, July 28th, there will be the Conversazione at the Institution, while Friday will be devoted to the reading and discussion of papers, and in the evening to the Institution dinner in the Connaught Rooms, Freemasons' Hall, Great Queen Street, W.C.

Royal Commission on Mines.—Sir H. H. S. Cunynghame has been appointed chairman of the Royal Commission on Mines, in place of the late Lord Monkswell.

Fatalities.—It is reported that on Monday afternoon, whilst operations were going forward at the Electric Blasting Co.'s works, at Trafalgar Colliery, Dean Forest, an explosion happened in the mixing shed, where Frank Phelps, 21, was engaged preparing a composition for mixing. Phelps was blown to pieces, the shed itself was completely wrecked.

On Saturday, Alex. Hinshelwood, an apprentice engineer, met his death in the steel works of the Glasgow Iron and Steel Co., Ltd., Wishaw. He had been engaged at the overhead electric charger, and had inserted several fuses. On the last occasion, however, the current was not switched off, with the result that on pushing the handle into position he received a shock which instantly killed him.

Post Office Factories.—According to an announcement in the *Times* the Postmaster-General has appointed a departmental committee to consider and report upon the organisation of the Post Office factories. The committee will be under the chairmanship of the Assistant Postmaster-General, Captain Cecil Norton, M.P., and the other members will be Mr. W. H. Allen, Assistant Controller of the Stores Department; Mr. H. S. Carey, Assistant Secretary of the Post Office; Mr. T. R. Ferens, Mr. L. W. B. Maclean, of the Accountant-General's department, and Mr. W. Noble, of the Engineer-in-Chief's department of the Post Office.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The staff of the Marylebone Borough electricity department have presented an onyx clock to MR. WM. THOS. KNIGHT, on his marriage.

Wimbledon T.C. is to grant an increase in salary of £13 a year to MR. H. N. NEWCOMBE and MR. R. WESTBROOK, engineers-in-charge.

The Bury T.C. has appointed MR. J. P. POTTS, of Birkenhead, as shift engineer at the Electricity Works.

The chairman and staff of the Farnworth U.D.C. Electricity and Destructor Works have presented a silver rose bowl to MR. R. B. LEACH on his resignation (already announced) of the post of chief electrical engineer.

MR. ERNEST PAGE, works superintendent at the Worcester Electricity Works, met with a serious accident on March 29th. He was cycling at night, and through a mishap sustained a broken jaw and a fractured leg. He was removed to the Infirmary.

MR. C. P. SMITH, who has recently completed his training as a pupil in electrical engineering with the Windsor Electrical Installation Works, has been presented by the staff with a fitted dressing-bag, upon leaving to take up the post of assistant engineer at the Canterbury Corporation Electric Lighting Works.

The Electricity Committee of the St. Helens T.C. has decided to increase the salary of MR. HOLLINGWORTH, the electrical engineer, from £400 to £450, and then to £500.

Tramway Officials.—Accrington Corporation Electric Tramway employés, on April 1st, made a presentation of a gold watch and chain to Inspector WILKINSON, who had resigned his post to leave for Australia.

General.—MR. ARTHUR W. STONEBRIDGE, who represented the late firm of Marples, Leach & Co. in India, has been appointed chief electrical engineer to Messrs. Burn & Co., Ltd., of Bombay.

MR. A. R. CHAYTOR, who, for some years has held positions under Messrs. Callender's Cable and Construction Co., has left that firm to take up the post of assistant mains superintendent under the Yorkshire Power Co.

MR. WALTER J. CRIDGE, who has for the past two years assisted in representing Messrs. Siemens Bros. Dynamo Works, Ltd., at their Sheffield branch, has taken up the position of representative in the Birmingham district, for Messrs. Ferranti, Ltd.

From among 103 applicants, the Shoreditch B.C. Lighting Committee has selected for the post of engineer-in-charge of the refuse destructor MR. J. HORN, of Huddersfield.

The Bridlington T.C. has appointed MR. F. MITTON as electrician in connection with the lighting of Prince's Parade, at a salary of £2 15s. per week during the season, and £1 12s. 6d. during the winter.

We understand that MR. JOHN D. MACKENZIE has severed his connection with the National Electric Signs Co., Ltd., of which concern he was manager. His future plans are not yet matured, but correspondence should be addressed in the meantime to 68, West End, Park Street, Glasgow.

We are sure that all the friends of that esteemed and respected veteran of British electrical affairs, MR. GEORGE OFFOR, will join with the ELECTRICAL REVIEW in its expression of deep sympathy with him in the loss he has just sustained by the death of his daughter Caroline, which occurred last week at his residence at Sydenham.

MR. W. CURRY, chief superintendent of the Postal Telegraphs at Newcastle-on-Tyne, has just retired after 45 years' connection with telegraphy. In 1865 Mr. Curry received an appointment on the staff of the Electric and International Telegraph Co., and was appointed to Newcastle-on-Tyne in 1868. That was the year that the Wheatstone automatic system was introduced, and the first installation was between London and Newcastle-on-Tyne. In 1870, when the Government took over the telegraphs, Mr. Curry's services were retained. He was promoted from time to time, and in 1899 was appointed chief of the telegraph and telephone services at Newcastle, which position he retained to the end of his service.

Obituary.—MR. MUSGRAVE HEAPHY.—We regret to state that Mr. Musgrave Heaphy, once well known as the technical adviser to the Phœnix Fire Office, and the original compiler of the widely known and generally used Phœnix Fire Office Rules, died on the 29th ult., at the age of 67 years. He had been in failing health for the last few years. At the age of 18 young Heaphy fought under Garibaldi during the famous campaign of 1860-1, and received two medals. Returning to England, he joined the civil engineering profession, receiving his training under Mr. Wilson, M.I.C.E., with whom also the late Sir Benjamin Baker was engaged. After practising for some time on his own behalf, he received an invitation to take service with the Phœnix Fire Office as technical officer, and to this service he devoted the rest of his life. His duties at the Phœnix required him to go into the question of electric lighting, which, in 1878, was just coming into public notice. As the result, he prepared a very careful report, followed in 1882 by the first edition of the famous Phœnix Fire Office Rules. The career of Mr. Heaphy from 1882 to 1905 is too well known to need repetition here. Not so generally well known, however, were the sterling qualities of his personal character. Those who were on intimate terms with him during many years, and probably knew more of the inner character of this in many ways remarkable man,

than even his close associates, hold that no man could be more loyal, upright and honourable in his dealings. He was never heard to say a word against anybody, though those who knew him well could judge to a certain extent, by the expression on his face, as to his opinion of any particular person under discussion, but any remarks made were always of a charitable nature. Some of us, as younger men, may have thought that we saw many imperfections in Mr. Heaphy, but in the course of time the imperfections once imagined assumed quite a different aspect. It is a remarkable thing that many of the technical requirements made by Mr. Heaphy in the early days of electric lighting, which were frequently referred to by hostile critics as Heaphy's fads, are now recognised practice. Some of our readers will remember Mr. Heaphy's strong recommendation to clients to use iron gas barrel with distribution boards about the year 1887, and it is a remarkable fact that all the installations erected under the supervision of Mr. Heaphy, even as early as 1884, are now standing examples of modern practice, and continue to be in excellent condition. Every job shows evidence of the extreme care given to details. As an example of Mr. Heaphy's prescience may be mentioned his statements at the public inquiry held by Sir Courtenay Boyle, relative to the proposed general increase of pressure from 100 to 200 volts. He made remarks to the effect that the proposed practice was ill-advised and insecure, and that in view of future developments the pressure was likely to be required at a lower, instead of a higher, value than 100 volts. His remarks were received almost with derision by many of the younger generation of electricians. There is no doubt that Mr. Heaphy worked very hard during the early days of electric lighting, and thereby weakened his health. He was strongly supported by such men as Lord Kelvin, Sir William Preece, Messrs. R. E. B. Crompton, J. E. H. Gordon, Alexander Siemens, Silvanus Thompson, S. Z. de Ferranti, General Webber, and other men who were in the van of the electric lighting movement, and by the leading technical journals. In those days he was a very frequent visitor to the offices of this journal, where he was always sure of a warm welcome. A great characteristic was his absolute loyalty to the Phœnix Fire Office, and more than one tempting offer that he received to take service in other interests was refused. It is a fact, too, that the Phœnix Rules would have been adopted by the Inst.E.E. and the combined fire offices, if Mr. Heaphy had consented to waive his only requirement, viz., that a small note be inserted to the effect that the Rules were originally drawn by the Phœnix Fire Office. There can be no doubt that the electrical profession is under obligations to Mr. Heaphy for the attitude he adopted in the early days of electric lighting. The responsibility of Mr. Heaphy's position was very great; owing to the limited extent of the industry 20 years ago, he held almost absolute sway, and with the best of results. Every article was submitted to him for his approval before being placed on the market, and every article that he did pass came to stay. On the other hand, he constantly refused to pass certain materials and fittings, and the results of practical experience have subsequently justified his objections. Many of the older members of the electrical industry will remember his courageous action in advising the fire offices to accept freely the risk of high-tension systems, even when many of the most able electricians were of opinion that high-tension currents were too dangerous to be allowed inside buildings. Mr. Heaphy's decision was of great importance to the development of high-tension systems. From the very beginning Mr. Heapoy had to encounter great hostility and jealousy from interested persons, and perhaps most of all from quarters whence he might have expected the greatest support. At one time Mr. Heaphy's services as a consulting engineer were in great request, and he was consulted by the highest authorities, but of late failing health greatly curtailed his activities, and since 1903 he lived practically in retirement, following upon a serious illness. There is little doubt that a great public service was performed by Mr. Heaphy when he drew up the Phœnix Fire Office rules, and these rules will never cease to be identified with his name. To Mr. Heaphy's life work is due the fact that the Phœnix Fire Office has a world-wide reputation as an electrical authority, and to the present day its advice is relied upon in connection with matters bearing upon the application of electricity. The directors of the company duly noted their appreciation on the occasion of his retirement some years ago. Mr. Heaphy was buried at Brookwood Cemetery on Saturday, April 2nd, in the presence of his family and old and staunch friends and admirers.

NEW COMPANIES REGISTERED.

Transmission, London, Ltd. (108,292).—This company was registered on March 19th, with a capital of £1,000 in £1 shares, to carry on a business not clearly defined. The subscribers are:—F. H. Clergue, Sault Ste Marie, Ontario, manufacturer, 1 share; Universal Transmission, Ltd., Toronto, 997 shares; E. Hildred-Harris, 13, Queen's Mansions, Westminster, S.W., 1 share. Private company. The number of directors is not to be less than two or more than five; the first are F. H. Clergue and B. H. Clergue; qualification, one share. Registered office, 25, Victoria Street, S.W.

Felgate Installation Co., Ltd. (108,335).—This company was registered on March 22nd, with a capital of £1,000 in 100 deferred shares of 1s. each and 995 ordinary shares of £1 each, to carry on the business of electricians, mechanical engineers, dealers in electricity, motive power and light, &c. The subscribers (each with one share) are:—B. P. Gibbons, Dingley, Tilehurst, gentleman; D. Kennedy, 18, The Forbury, Reading, accountant. Private company. The number of directors is not to be less than two or more than five; the first are B. P. Gibbons and S. J. Cook; qualification, £20; remuneration, one guinea each per board meeting attended. Registered office, Broadway Buildings, Reading.

Russian Municipal and Industrial Co., Ltd. (108,350).—This company was registered on March 22nd, with a capital of £25,000 in 22,500 preferred ordinary shares of £1 each, and 50,000 deferred ordinary shares of 1s. each, to take over a concession granted to M. Chosidow by the Council of the City of Orenburg, and to carry on the business of contractors, builders, engineers, railway and tramway constructors, electricians, manufacturers, prospectors, miners, &c. The subscribers (with one preferred ordinary share each) are:—D. Struyf, Rue Quellin, 30, Anvers, engineer; M. Chosidow, New London Street, E.C., merchant. Private company. The number of directors is not to be less than two or more than ten; the first are W. de Kowalewsky, Prof. M. Dawnor-Zapolsky, S. Goldberg, M. Chosidow and D. Struyf; qualification, 250 preferred ordinary shares. Registered office, 3, New London Street, E.C.

West End Mills (Bradford), Ltd. (108,476).—This company was registered on March 29th, with a capital of £1,000 in £1 shares, to take over the business of millowners and lessors of mill, warehouse and office premises, and generators and suppliers of steam and electrical power, carried on by J. W. Firth and W. Wand, on the West End Mills Estate, Bradford. The subscribers are:—Mary W. Lupton, 3, Longcroft Road, Ben Rhydding, Yorks., 998 shares; J. W. Firth, Brierwood, Ilkley, Yorks., woolcomber, 1 share; Mrs. I. W. Firth, Brierwood, Ilkley, Yorks., 1 share; C. W. Lupton, 100, Grange Road, Bradford, engineer, 1 share; Mrs. E. H. Lupton, 100, Grange Road, Bradford, 1 share. Private company. The number of directors is not to be less than three or more than five; the first are Mary W. Lupton, J. W. Firth and C. W. Lupton; qualification, £1. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

A. Dean & Co., Ltd. (108,457).—This company was registered on March 29th, with a capital of £1,000, in £1 shares, to carry on the business of electrical engineers, dealers in electrical fittings, cables, wires and sundries, contractors for electric installations, &c. The subscribers are:—A. Dean, London Road, Norbury, electrical engineer, 100 shares; Mrs. M. St. C. Dean, London Road, Norbury, 150 shares. Private company. The number of directors is not to be less than two or more than four; the first are A. Dean and Mrs. St. C. Dean; qualification, £100; remuneration, £100 per annum, divisible. Registered office, London House, London Road, Norbury, Surrey

Electrical Advertising Co., Ltd. (108,465).—This company was registered on March 29th, with a capital of £1,500 in £1 shares, to carry on the business of engineers, machinists, electricians, advertisers, advertising agents and specialists, advertising machine makers and dealers, &c. The subscribers (with one share each) are:—C. F. Kennedy, 13 and 14, Abchurch Lane E.C., solicitor; E. J. Merrill, 13 and 14, Abchurch Lane, E.C., law clerk Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the subscribers. Registered C. Fred Kennedy & Co., 13 and 14, Abchurch Lane, E.C.

CITY NOTES.

Chiswick Electricity Supply Corporation, Ltd.

The report of directors for the year ended December 31st, 1909, states that the undertakings at Chiswick and Aberystwyth owned by the corporation continue to give good results, the number of consumers added during the year showing a satisfactory increase. During the year £2,904 has been expended on capital account for machinery, mains, free wiring, &c., while £225 has been written off for depreciation. First mortgage debenture stock to the value of £80,000 was issued in January, and out of the proceeds the £50,000 first debentures previously issued were redeemed and certain loans repaid. The 100 founders' shares which have figured in the accounts hitherto have been converted into ordinary shares. The figures below show how the corporation's liabilities on share and loan account have stood at the end of each year for the last three years:—

	1907.	1908.	1909.
On shares	£62,800	£62,800	£62,800
On loans	55,919	63,000	80,000
Total..	£118,719	£125,800	£142,800

The following table shows the increase in the number of consumers, the revenue yielded and the profits distributed:—

At the end of the year.	Number of consumers.	Revenue.	Profits.
1907 ..	1,559	£14,608	£6,846
1908 ..	1,692	14,867	6,834
1909 ..	1,875	15,129	7,592

The profits made by the corporation for the year after paying sinking fund premium and trustees' fees were £7,593. Out of this sum interest on first mortgage debenture stock amounting to £3,442 has been paid, leaving £4,151 to the credit of the net revenue account. The price of coal has remained normal, and the cost of production is lower than in any previous year. At Chiswick it compares favourably with the cost in any generating station of similar capacity; at Aberystwyth a new Diesel engine generator is being installed to effect further economies. The ratio of metallic-filament to carbon-filament lamps still increases, but it is satisfactory to observe that the effect of this on revenue continues to be compensated for by the increase in the number of consumers. The results of the year's working will enable a dividend to be paid on the ordinary shares at the rate of 6 per cent. for the year, being the same as paid for 1908. The directors propose that this dividend be paid, which will absorb £3,768, and that the balance be carried to the depreciation reserve fund.

Sir Thomas Brooke-Hitching, chairman, presided on Wednesday at the offices, 14, Ironmonger Street, E.C., over the annual meeting of the above company.

The Chairman formally moved the adoption of the report, and this was seconded by Mr. W. B. Esson and agreed to.

Sir T. Brooke-Hitching and Mr. J. Courthope Peache were re-elected directors.

West London and Provincial Electric Supply Co., Ltd.

The directors' report for the year ended December 31st, 1909, states that the revenue of the company is derived from the dividends paid on the shares of the Chiswick Electricity Supply Corporation, Ltd., which this company owns, from the fees charged for managing the business of the corporation, and acting as engineers in respect of additions to the corporation's plant and machinery. The accounts of the Chiswick Electricity Supply Corporation, Ltd., show, after paying interest on the first mortgage debenture stock, a profit of £4,151, out of which the directors propose to pay a dividend at the rate of 6 per cent. per annum on its shares. This will be received in due course by this company, whose accounts herewith show a balance at the credit of the profit and loss account in the balance-sheet of £3,517. The directors propose to apply the above balance of £3,517 to the payment of a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for the year ending December 31st, 1909, and to the payment of interest at the rate of 4½ per cent. per annum on the funding certificates for the same period.

The meeting was held on Wednesday at the offices, 14, Ironmonger Lane, E.C., under the chairmanship of Sir T. Brooke-Hitching.

The Chairman, in moving the adoption of the above report, said he could congratulate the shareholders on the steady progress made. They knew that for health, cleanliness and convenience electric light was far ahead of any other kind of illuminant. For illumination it was as far ahead of gas as gas was ahead of candles. The company had made steady progress in the last 10 years, and each year had shown an increase of profit. Last year, of course, beat the record, which was extremely satisfactory, holding as they did a monopoly for the supply of electricity in Chiswick, an area two and a-half times as large as the City of London, and also in the old town of Aberystwyth, North Wales. The Chiswick Council had the right to repurchase the undertaking in 1915, and at other subsequent periods as a going concern, the purchase price being based upon the profits of the company. These were singularly satisfactory terms which were made when the company acquired the undertaking from the Chiswick Local Board many years ago, and every year the purchase was delayed would make the price to be paid heavier. When he motored through the brilliantly-lighted main road at Hammersmith into the dark gas-lighted road at Chiswick, he confessed he marvelled at the absence of enterprise on the part of the Chiswick people in not adopting electricity for road lighting. He thought also that the time would arrive when their present one-sided so-called Free Trade would come to an end, and then they would have on the convenient Thames side at Chiswick numerous factories whose machinery would be actuated by electricity and which would find employment for thousands of artisans, and would take a large day-load from the West London station. The Aberystwyth station was making satisfactory progress, and he heartily congratulated the shareholders on the constant advance of their properties.

Mr. W. B. Esson seconded the motion, and said that whilst the progress made at Chiswick was not a rapid one, yet it was steady and constant, which was perhaps all one could expect from electrical enterprises.

The motion was carried, and the Chairman and Mr. Peache, the retiring directors, were re-elected.

Replying to a vote of thanks, the Chairman said he did consider it satisfactory to be able to present such an excellent report, notwithstanding that the metallic-filament lamp had caused the consumption of less current by individual consumers.

Guildford Electricity Supply Co., Ltd.

Mr. H. P. Smallpiece presided last week over the annual meeting of this company, and in moving the adoption of the report (see Electrical Review, page 524), he said that the increase in receipts was the largest in any year since 1904, though every year had shown steady progress. On the other side there was an increase in the expenditure of nearly £600. That was due to a large extent to an increase of about £145 in the rates and taxes, and £260 on salaries. Hitherto the payment of officials engaged in work involving expenditure of capital had come out of capital account, but the auditors considered that a portion of the salaries was properly chargeable to revenue account, and the apparent increase was due to that fact.

Questions were raised as to the basis upon which the board had calculated the amount of depreciation. One speaker said that, so far as he could make out, only 2 per cent. had been deducted for depreciation on machinery, whereas it ought to be at least 10 per cent. Another speaker remarked that the provisional order was granted in face of strong opposition from the Guildford Corporation for 33 years. He believed they had only 16 more years to run, and he was afraid the criticisms with regard to depreciation were very much to the point, because they would have a tremendous balance to wipe out in that time, and at the end of 33 years the Corporation could take over the undertaking at a nominal purchase price.

Replying to the criticisms, the Chairman said of course the directors would have liked to have put a larger sum to the depreciation account, but in that case he was afraid some of the shareholders would say they wanted the dividend. The directors thought the sum allowed was sufficient for the year. It was larger by a considerable amount than it was a few years ago, and if the profits were sufficient in future years to allow a still larger sum, the directors would consider whether it could not be allocated in that way.

Rhondda Tramways Construction Syndicate, Ltd.—The directors' report states that the net profit earned during the year was £20,044, and of this amount £3,500 has been placed to the reserve and renewals account; £16,000 has been credited to the syndicate, and £543 carried forward. The amount to the credit of the syndicate's profit and loss account for the year was £15,966, and with the balance of £1,685 brought forward, the total was £17,651. An interim dividend of 3 per cent. having been paid, a balance of £10,151 remained, and the directors recommended that a final dividend of 3 per cent. be declared, leaving £2,651 to be carried forward. The expenditure was 50 80 per cent. of the gross receipts, which were £40,864. The number of passengers carried during the year was 8,821,095; the traffic receipts for the year showed a substantial increase, and the first year's working was satisfactory. The Rhondda Council had a Bill before Parliament this session to authorise various extensions to the tramways. The heads of an agreement between the Council and the company had been agreed upon, and if the Bill received the Royal Assent the working of the extensions should add to the profits of the company. The directors propose, when they consider the time favourable, to offer the debentures and preference shares of the Rhondda Tramway Co., Ltd., for public subscription.

South Wales Electrical Power Distribution Co.—The report of this company (as abstracted in the *Financier*) states that the arrangement referred to in the last report for the construction by the Treforest Electrical Consumers' Co., Ltd., of a connecting cable between the generating station at Treforest and the Cwmbran area, has been duly carried out. The connection was completed in May last, and since then the supply to the Cwmbran area has been entirely taken over by the Treforest Co. This arrangement has enabled the Cwmbran generating station to be shut down, and the expense of working it as a separate unit to supply the consumers in that area has thus been saved to this company. The directors report that the Treforest Co. has made steady progress during the last 12 months, the cost of production having been materially reduced and the output increased. Some new consumers have been connected, and negotiations are proceeding with others who are contemplating taking a supply. To meet the growing demand for current the Treforest Co. are considering the question of providing further capital for an increase of the generating plant.

Indo-European Telegraph Co., Ltd.—The directors recommend a dividend for the six months ending December 31st, 1909, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax. They also recommend a special distribution of 15s. per share, free of income-tax, out of interest accrued during the year upon certain investments and advance accounts. The dividend, bonus and special distribution will be payable on and after May 2nd. The transfer books will be closed from April 14th to 27th.

Great Northern Telegraph Co., Ltd. (of Denmark).—Owing to the increased receipts in 1909 from the company's participation in other telegraphic undertakings, and still more to the fact that last year there has been a profit on exchange instead of a heavy loss as in the previous year, the board of directors proposes, notwithstanding a considerable decrease in the ordinary traffic receipts, to distribute the same dividend and bonus for the year 1909 as for the preceding year, viz., 18 per cent. (of which 5 per cent. has already been paid), and to set aside the usual amounts to the reserve and pension funds, viz., £55,556 and £8,333 respectively.

Oriental Telephone and Electric Co., Ltd.—The directors recommend (the annual meeting is to be held on 27th inst.), subject to anal audit, the payment of a dividend at the rate of 6 per cent. per annum on the preference shares for the half-year ended December 31st last, less income-tax, and a final dividend of 5 per cent. on the ordinary shares issued, free of income-tax, making a total of 8 per cent. for the year. The share transfer books will be closed from the 14th to 27th inst.

Anglo-American Telegraph Co., Ltd.—The directors have resolved, after placing £5,000 to the credit of the renewal fund, to declare an interim dividend for the quarter ending March 31st, 1910, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable on April 30th.

Correction.—In our "Stocks and Shares" letter (March 25th issue) we incorrectly stated that the North Metropolitan Tramways Co. had brought out a debenture issue. The reference was, of course, to the issue of 5 per cent. debenture stock by the Metropolitan Electric Tramways, Ltd., of which brief mention was made on p. 442 of our March 18th issue.

Clyde Valley Electrical Power Co.—At the half-yearly meeting held in Glasgow, Mr. A. Bonar Law, M.P., presiding, it was reported that the credit balance on revenue account for the half-year amounted to £8,929, and that contracts for supply had been entered into at date to the extent of 35,000 H.P.

Telephone Co. of Egypt, Ltd.—The directors have declared a dividend of 6 per cent. on the preferred and deferred shares for the half-year to December 31st, making 10 per cent. for the year, carrying £500 to reserve for a pensions scheme, and £42,326 forward.

Mexican Light and Power Co., Ltd.—The directors have declared a dividend of 1 per cent. on the ordinary shares.

Willans & Robinson, Ltd.

The ordinary general meeting of this company was held on Tuesday at the Cannon Street Hotel, Mr. James C. Peache presiding.

The Chairman, in moving the adoption of the report and accounts (see Electrical Review, page 523), said he had to express the great regret of the directors that the result of the half-year's working should be of so unsatisfactory and disappointing a nature. It was due entirely to the difficult commercial situation that has recently prevailed. The state of trade throughout the year 1909 had been exceedingly bad—in speaking of trade he referred in particular to the production of electrical generating machinery, to which the operations of the company were chiefly directed—and competition, especially in this business, had been exceedingly keen. It had been impossible to obtain a sufficient volume of orders to keep the shops fully employed, and for the orders that had been obtained it had been necessary to accept prices that had left at best but a small margin for profit. Under normal conditions it was the duty of those in charge of a business such as this to build up hidden reserves and safeguards during periods of prosperity, in order to provide a means of tiding over periods of depression without reflecting their full effect on the balance-sheet of the company, and without its being necessary to call on the shareholders to forego their dividends. This company, however, was not working under normal conditions. Since 1904 its resources had been largely utilised in liquidating liabilities incurred prior to that date. A total of some £124,000 had since 1904 been paid out of the cash resources of the company in liquidating those liabilities. It had thus not been possible in the case of the company to make provisions against a difficult period such as the one the company was now passing through. Profits when they were made had to be largely used in wiping out the past instead of being kept to safeguard the future. The difficulties which the company had now to face did not end with the liquidation of old debts. The capital raised for the construction and equipment of the Queen's Ferry Works, and other obligations incurred owing to the non-success of those works, imposed a heavy burden on the Rugby business. The capital employed at Rugby at the present time in buildings, plant, and working capital was no larger than it was in the year 1901, but whereas the charge for debenture interest and preference dividend was then £8,750 for the half-year, the half-yearly charge on account of debenture interest, preference dividend, and funding certificates now amounted to about £16,000, and if to this was added the cost of maintaining the Queen's Ferry Works, say £600-£700 per half-year, there was now a total half-yearly preferential charge of £16,600 against the Rugby business, instead of £8,750 as in 1901. This constituted a heavy handicap even in good times, and in bad times like the present the cumulative preference charges quickly mounted up. At December 31st they had amounted to nearly £17,000. While, however, the directors were anxious that the shareholders should make due allowances for the difficulties under which the business of the company had now to be carried on, at the same time they with confidence asked the shareholders not to be unduly discouraged by the present setback in the profit and loss account. In recent half-years, under more normal conditions of trade, the company had earned good profits. For two years, from 1906 to 1908, the average half-yearly profit (before payment of debenture interest) amounted to over £23,000 per half-year. The works were now better equipped than they were during those years, and the staff was certainly not less efficient. Given, therefore, a reasonable improvement in the state of trade there was every prospect of good profits being again earned. Steps, too, were being taken to reduce the heavy preferential charge on the business. Already, by means of the fire fund, the debenture debt had been reduced from £245,495 to £215,769, and there were still funds available by which the debenture debt would be further reduced Whenever the Queen's Ferry Works were sold the directors hoped, with the consent of the trustees, to apply the proceeds of the sale to the further redemption of debenture stock, a procedure which would have a double effect on the half-yearly preferential charge, for besides the reduction of debenture interest there would be the saving of the £600 to £700 at present spent on the upkeep of the Queen's Ferry Works. There was at present some evidence of an improvement in trade, although there was no indication of improvement in the miserably inadequate scale of prices which had to be accepted if work was to be obtained. There has recently been a well-marked increase in the volume of orders obtained, but orders must be secured in considerably greater quantity before a really prosperous period could be expected. The directors regretted to have to report that the Queen's Ferry Works still remained unsold. The negotiations referred to in October last came very near to a successful completion, but fell through at the last moment. Until the political horizon cleared and some measure of confidence was restored to commercial enterprise, he feared they must be content to wait for a purchaser. At the last two half-yearly meetings the subject of an appointment to the vacant post of chairman had been referred to. The board had devoted a great deal of attention to the subject, and in the end had come to the conclusion that the interests of the company would be best served by the appointment of a really capable man as assistant managing director, more especially in charge of the commercial part of the business, and for the present, at all events, to allow the post of chairman to remain vacant. Mr. Davenport, after careful consideration and inquiry, had decided to give up a good position in order to join the company, and he thought that they might take courage from the confidence in the future of Willans & Robinson that Mr. Davenport displayed in thus throwing in his lot with them at a time when the difficulties of the company were so apparent. Taking the asset side of the balance-sheet, premises, plant, &c., at Rugby, after deducting depreciation, showed an increase of £3,005. A number of obsolete tools had been replaced by up-to-date machinery. The necessary cash had been provided with the permission of the trustees for the debenture-holders, from the proceeds of the sale of plant at Queen's Ferry, and a balance of £6,600 still remained in their hands applicable for the purchase of further new plant. The Queen's Ferry premises and plant, &c., stood at £88,757. It was probable that the full amount would not be realised on sale, but there was a reserve fund on the other side of the balance-sheet to meet any such deficit. Patents and development account showed an increase of £2,104. Depreciation as usual had been written off this item, but while new lines of manufacture were being introduced, there was good reason for setting a part of the initial expenditure against this account. When the business was in a strong enough position it was very desirable that opportunity should be taken of writing off this account altogether. In the meantime it was not feasible to do more than write off the usual rate of depreciation. The Diesel engine suspense account was not being added to. A half-yearly amount of £729 was written off this account. The whole account, therefore, would disappear in 2½ years from now. Work in progress stood at cost, no profit being taken into account. Nothing but sound assets was included in this item. The careful system of scrutiny introduced by Sir Gilbert East has been rigidly adhered to. During the half-year under consideration a sum of £1,730, in addition to the ordinary rate of depreciation, had been written off the value of stocks, in scrapping or drastic writing down of obsolete or little-used stores. This process had been in operation for many years past, and even during the last bad half-year, it had not been considered desirable to suspend the process. The debtor balances represented good debts. Such few doubtful accounts as were included were fully covered by reserves. The municipal and other company work which was undertaken involved delayed payments, and accounted for the large amount of this item. Cash in the bank and in hand amounted to £23,814, while investments at cost, amounting to £28,020, were held in readily realisable securities, and were available for the general purposes of the company's business. Turning to the liability side of the balance sheet, the debenture debt had been reduced during the half-year by £20,939 by redemption from the proceeds of the fire insurance fund, and the profit realised on this transaction, amounting to £4,545, has been added to the reserve fund. As indicated at the last half-yearly meeting, the reserve fund had to bear the loss of £15,000 paid in respect of a lawsuit. The directors had also deemed it advisable to take a further sum of £10,000 to meet certain outstanding accounts. This was to cover certain losses or liabilities incurred some years ago, but which did not become assessable until this half-year. Under more prosperous circumstances losses such as these would be dealt with in the profit and loss account. Under present circumstances it appeared more reasonable to place them against the reserve fund. After making these deductions, the reserve fund stood at £42,522. Going on to the profit and loss account, the item salaries to staff again showed an increase. It had been necessary to increase the staff in the selling department for the purpose of doing what was possible to secure work in these bad times. There could be only one measure for this question of staff or for any other item of expenditure, and that was what was best in the interests of the shareholders. That object the directors, to the best of their ability, kept in view and acted on, and he did not doubt but that their new director, Mr. Davenport (if they elected him), with his extended experience in engineering businesses, would render valuable assistance in ensuring that for such expenditure as it was considered wise to incur, the company should have an adequate return. The loss shown on the profit and loss account was £8,282, and, in addition, it had been necessary, as previously stated, to draw on the reserve fund. It might be pointed out that debenture interest and depreciation together more than accounted for the whole of the loss shown on profit and loss account. Following the tradition of this company, the directors had not attempted to conceal or gloss over any losses or liabilities. It would be a great relief to him if the shareholders could realise—as the directors full well knew—the great difficulties that industrial concerns, and especially those engaged in the electrical business, had had to contend with during the last year or so. Further, it would be a great source of encouragement to the directors if shareholders would, when they were able, pay a visit to Rugby, and see for themselves how the business was being conducted. He could assure them that the directors and staff would be only too glad to receive such visits, and give any information in their power.

Mr. Leslie S. Robertson, in seconding the motion, said that he re-echoed the note of regret which had fallen from the chairman at the result of the past half-year's work. At the last meeting he ventured to suggest that they were not out of the wood, and neither were they. Whatever might be their opinion of the hereditary principle as regarded another place, the fact remained that the troubles which that company had inherited were considerable. They had spent no less than £136,000 due to matters of the past. Then they had cumulative interests to bear, and that was a severe burden indeed. Another factor was that they had had to increase their business with the same amount of capital as hitherto. They had no nest-egg to fall back upon, and consequently they had to accept contracts at prices which they would not do were they in a stronger financial position. In order to carry on the business successfully they had to have a turnover of £150,000 every half-year, and that they had not got, but he was sure that Mr. Davenport would do all he could to make up the deficit.

He would like to say, as one who had seen something of the internal working of the company, how hard Mr. Peache and those immediately associated with him worked for the company.

Sir Gilbert East said that in the report it was stated that it was proposed to appoint Mr. Davenport as assistant managing director, but it did not state that fact in the resolution which was to be submitted appointing that gentleman to the board. What they really wanted was a commercial director, who would work independently, and be only subject to the board—not be under the control of Mr. Peache, whose personal management was written over the whole of the accounts. He would move that the word "assistant" should be deleted. Referring to the lawsuit which had cost the company £15,000, Sir Gilbert reminded the directors that in October, 1908, he obtained an answer from the then chairman that provision was being made for any loss arising on that lawsuit. He would also like to point out that the salaries of the staff, exclusive of directors' fees, were actually £9 more than when the Queen's Ferry Works were in operation. The salaries appeared to be increasing at the rate of £3,000 a year, which was reckless finance. He warned them 18 months ago that they were on the brink of a precipice; now they were hanging over it, and if the company failed, there would not be one single penny for any shareholder—preference or ordinary.

Mr. Willans seconded the amendment to delete the word "assistant," and was proceeding to ask whether the £1,729 written off in respect of obsolete stock referred to rejected parts of the Diesel engine, when

The Chairman, interrupting, said it had nothing to do with the Diesel engine.

Mr. Lyons asked whether the company could really afford to pay Mr. Davenport £1,500 a year. He (the speaker) was strongly in favour of amalgamation, and if they created vested interests, they would rather hamper any such scheme.

Mr. Alfred Holland referred to a meeting of some of the largest shareholders which was held to consider the question of the appointment of Mr. Davenport, and remarked that the general opinion at that meeting seemed to be in favour of the proposal. The question was, "Was the labourer worthy of his hire?"

Mr. Walter Stewart deprecated any attacks on the present management of the company. The difficulties which the directors had encountered were brought about by things which happened in the past, when the present managing director was not in control of the company.

A Shareholder: He was on the board.

Mr. Walter Stewart: That may be, but he had not the control which he has now. Continuing, the speaker said this was not the time for internal dissension amongst the shareholders. If the body of larger shareholders which had met the directors considered the appointment of Mr. Davenport desirable, he did not think any good would be done by opposing it.

Col. Ruckett remarked that if they had confidence in the board they would support the proposal.

The Chairman, in reply to the criticisms of Sir Gilbert East, said that that gentleman seemed to take exception to the directors taking credit for what they had done, but he (the speaker) considered they were quite justified in calling attention to the fact that they were doing their duty. As to the remarks of Sir Gilbert about the appointment of a new director, it was at Mr. Davenport's own suggestion that the position which it was proposed he should occupy would be known as "assistant managing director." The creating of separate departments might lead to antagonism amongst the staff, and that was another reason why Mr. Davenport would not act independently. With reference to the question whether the £10,000 which was required to meet outstanding liabilities should be taken from reserve or the debt guarantees fund, that was really a matter of book-keeping, and so was the question of the money paid for the lawsuit. The money had to be paid, and it did not really matter from where it came.

Sir Gilbert East: We had been told it was being provided for in October, 1908.

The Chairman said he did not agree with the interpretation that Sir Gilbert put upon the late chairman's remarks. Continuing, the chairman said that, as to the suggestion of amalgamation, they were not in a particularly fortunate position for making overtures of that kind. A shareholder had asked whether they could afford the £1,500 which they proposed to pay Mr. Davenport. Of course, the board believed that they would get increased business through that gentleman's appointment. Mr. Davenport would conform to the articles of association, which required a director to hold a qualification of 500 shares.

Canon Waugh asked whether the £10,000 referred to would cover all the liabilities which the board knew of at present. He would also like to thank the secretary for noting his remarks about not sending out the report on Sunday, but by a grim irony of fate he sent it so as to reach them on Good Friday.

The Chairman said the £10,000 would cover the present liabilities of the company.

The report was adopted, and the amendment to delete the word "assistant" in reference to Mr. Davenport's appointment was lost.

The following resolution, on the motion of the Chairman, seconded by Mr. L. Robertson, was subsequently carried:—

That Mr. Frederic R. Davenport be, and is hereby, appointed a director of the company, and that his remuneration be at the rate of £1,500 per annum, payable quarterly, with the proviso that when the affairs of the company are again placed on a profit-earning basis, Mr. Davenport shall be entitled to receive a further suitable contingent remuneration dependent on the prosperity of the company, to be fixed by the company in general meeting; and that the directors be, and are hereby, authorised to enter into an agreement with the said Frederic R. Davenport, binding him to devote his whole time to the service of the company upon the foregoing terms.

Gateshead and District Tramways Co., Ltd.

The directors' report for 1909 states that the total revenue was £53,365, and after deducting all expenses chargeable to revenue, including repairs and maintenance, interest on mortgages, and a sum of £2,650 placed to provision for permanent way renewals, there remains a profit on the year's working of £20,539, plus £922 brought forward, making a total of £21,461. Of this, the directors recommend that £3,454 be placed to depreciation and reserve account, increasing it to £17,000; sinking fund for redemption of mortgages £1,860, write off depreciation of investments (the Birmingham and Midland Tramways debenture stock) £450, dividend for the year on £12,610 6 per cent. preference shares £757, dividend for the year on £120,000 5 per cent. preference shares £6,000, dividend on the ordinary shares (6 per cent. per annum) £8,100, carrying forward £840. The decrease in traffic receipts is partly due to the closing down of an engineering works in Gateshead, where about 1,000 men were employed, the transfer of employés from the N.E. Railway Engineering Works at Gateshead to York, and to the opening of a railway station on the Dunston route. The expenses have, however, been considerably reduced, and the directors consider the result, under the circumstances, satisfactory. The expenditure chargeable to the capital account during the year amounted to £4,817, making the entire capital outlay of the company in and upon the undertaking, £318,385.

The Bill referred to in the last report, under which *(inter alia)* the power of the Corporation to purchase the lines in Gateshead under the Tramways Act, 1870, is deferred until 1930, received the Royal Assent on August 16th last. Tenders were invited, and a contract has been let to Messrs. Wm. Griffiths and Co., Ltd., for the extension of the present Bensham route, and the doubling of the Low Fell section as authorised by that Act. The purchase of the land adjacent to the present car-shed, referred to in the last report, was completed on January 18th last. Tenders were invited, and a contract has been let to Mr. J. Milne, of Gateshead, for the erection on this land of extensions to the present car-shed. The owners of the colliery level crossing wagon-way just below the present terminus at Wrekenton have now arranged for the removal of the haulage ropes which at present cross the public road, and the construction of the uncompleted section of the Wrekenton Light Railway will, it is hoped, be carried out by this company by the end of the year.

A quotation has been obtained for the ordinary shares on the Newcastle and London Stock Exchanges. The undertaking has in all respects been maintained, as in years past, in good order and repair.

	1908.	1909.
Route miles—Single line	5·26 miles	5·26 miles
Double line	6·02 ,,	6·02 ,,
Passengers carried	12,126,530	11,970,002
Average receipts per passenger	1·03d.	1·03d.
Average expenditure per passenger	·58d.	·57d.
Proportion of expenses to receipts	56 per cent.	55 per cent.
Number of cars in stock	51	52

Mr. C. R. Greene, J.P., presided on Thursday last week over the 28th annual general meeting of this company, held at the British Electrical Federation Offices, Kingsway, W.C.

The Chairman, in moving the adoption of the above report, said that the traffic receipts were £715 less than the previous year, and although this had been more than counterbalanced by the reduction in the expenses, a portion of this reduction was accounted for by the saving on the permanent way on the Low Fell section, as only those repairs were done on that section which were absolutely necessary, having in view the fact that those lines were to be taken up at an early date in order to allow for the doubling of the track. The profit from the carrying of parcels was also slightly down, while the interests on investments and deposits were less by £100. This last item would be still further reduced in the coming year, as a large portion of the money upon which interest had been earned during the past year would be utilised in the carrying-out of works authorised by the company's recent Act. The power and running expenses were £619 less, and the repairs and maintenance expenses were down by £417. The amount set aside in respect of provision for permanent-way renewals was £141 less; this was accounted for by the fact that last year there was a less number of car-miles run than in 1908. Looking at the administration and general expenses, the first item—rates and taxes—showed a large increase, namely, £657, which was due to an increase to their assessment which took place on the latter part of 1908. The total expenses of administration, in spite of the large rise in rates and taxes, only showed in the aggregate an increase of £100. He might point out with reference to the sums set aside for permanent-way renewals, which was a considerable one, that it was really in the nature of a dividend equalisation fund, for if any extraordinary repairs had to be carried out in any one year, the difference between the ordinary and the extraordinary expenditure would be borne by that fund. The decrease in traffic receipts was partly due to the closing down of an engineering works in Gateshead, and the transfer of the employés from the North-Eastern Engineering Works at Gateshead to York, and partly to the opening of a railway station on the Dunston route. The dividend was 1 per cent. less, but a large sum had been set aside for reserves which, he thought, was a policy that the shareholders would approve of. Whatever had been the state of trade in other parts of the kingdom, at Gateshead it was moving slightly towards the better. It certainly had improved lately, and he trusted they would see an expansion of that improvement, for which there was abundant room; so far, however, he regretted to say that their returns had been decreasing even as compared with 1909. The present disturbed condition of the coal trade in the district owing to the Miners' Eight Hours Act had been, and continued to be, a source of anxiety to the directors. The total number of passengers carried had decreased by 156,528. The chairman paid a warm compliment to the services rendered by the manager, secretary and staff.

Mr. C. S. B. Hilton seconded the motion, and the report was adopted.

A resolution was carried authorising the payment of the directors' travelling expenses.

Bath Electric Tramways, Ltd.

The directors in their report to December 31st, 1909, state that the traffic receipts show an improvement over those of the previous year to the extent of £1,741, to which both the motor-omnibuses and tramways have contributed, in spite of the adverse weather conditions which prevailed during the greater part of 1909. The expenditure has again been reduced, but the efficiency of the permanent way, plant and system generally, has been well maintained. The improvement in earnings for the last year has been continued during 1910, the receipts for the first 11 weeks of this year showing an increase of £915, when compared with those for the same period of 1909. In fact, for the 11 weeks ended on 16th ult., the earnings are in excess of those for the first 11 weeks of any previous year. After charging the expenses of operation and administration for the year there remains a balance of £13,614, plus £2,493 brought forward, making £16,107, from which has to be deducted interest on 4½ per cent. first mortgage debenture stock paid and accrued to date, £6,082; second instalment of sinking fund for first mortgage debentures, £1,000; interest on loans, £1,311; dividend on the preference shares for the year, £3,750; leaving a balance of £3,964, which the directors recommend should be carried forward.

Sir James Sivewright, K.C.M.G., presided at Winchester House on Monday over the seventh annual meeting. In moving the adoption of the above report, he remarked that they were in a better financial position than they were when he last addressed them. The prosperity of an undertaking such as the Bath Electric Co. was contingent upon two important factors—one was the spending power of the public, and the other, which was equally, if not more, important, that of the weather. They depended more on the latter, perhaps, than on the former, for Bath was not a manufacturing centre, but was an inland watering place. Last year, by economies which they had exercised in the strictest possible way, and with additional earnings, they had been able to get in revenue about £1,500 in excess of 1908. He might say that that increase was being more than maintained during the current year. In 1909 there was a decided increase in the net revenue over 1908, and for every week during the current year there had again been an increase over 1909. In fact, for the 13 weeks which had expired, he was glad to say that their net revenue was no less than £1,094 in excess of the corresponding period of 1909. He would, however, point out that these figures included the Easter traffic, but even leaving that out they had a net profit of over £750 in excess of the previous year. He mentioned that fact in view of the non-declaration of a dividend on the preferred ordinary shares, but he thought he could hold out something more than hope that a dividend on their shares during the current year would not only be earned, but declared. They hoped soon to extend their operations to Saltford. They already had the power under the Act, which they had obtained from the Board of Trade. From the balance-sheet it would be seen that the company still owed the bankers £25,000, and that was one of the reasons why they did not feel justified in declaring a dividend, and it might be necessary in order to wipe out that item to make a fresh issue of debentures or preference shares. When that was done, there would be nothing to stand in the way of their using the earnings for which he might call legitimate purposes, namely, the paying of dividends. So far as depreciation was concerned, they had a reserve fund, and a depreciation account, and further, they had also redeemed £3,400 of debentures. The gross traffic was about £1,800 in excess of the previous year, and the motor-omnibuses had also shown a profit of £742. They were carrying forward this year £3,964, as compared with £2,493, which would have been sufficient to pay a dividend of 5 per cent. on the ordinary shares if the money had been available, but in view of the financial position of the company, to which he had alluded, and the fact that money was getting cheaper, and that they hoped to wipe off their debt and carry out further extensions, they did not feel justified in declaring a dividend.

Mr. A. A. Campbell Swinton seconded the motion.

The Chairman, replying to a shareholder's question, remarked that the directors were as anxious as anybody to clear the debt to the bankers. It was rather curious that one of the reasons why they could not get it wiped off, was because it was so small—no financial house would take it up, but in view of certain works of a remunerative character, which they proposed to carry out, it was hoped that they would able to make an issue of £30,000 or £40,000, which would be more readily handled than an issue of £25,000. They had issued no debentures this year. With regard to the criticisms made at the last meeting with reference to the operating costs per car-mile of their company as compared with other companies, the board had gone very carefully into the matter, and he thought it could be shown that their costs were amongst the lowest recorded by similar concerns in the United Kingdom. They had obtained statistics which had been published concerning 25 companies and 76 Corporations, and there were only three companies which had a lower operating cost per car-mile than that of their company, and only one Corporation showed a lower figure. The cost per car-mile of the Bath Electric Co. was 4·908, but from that had to be deducted the expenses of the parcels department — ·185d., which gave them an actual figure of 4·723d. If they included their London expenses, they had a total figure of 5·092d. He was not quite sure whether the figures that had been published concerning other undertakings included directors' fees, &c., but theirs, as he had just stated, did. The three companies which showed a lower cost were Taunton, Dublin and Cork. In the case of Taunton, that was an offshoot of the British Electric Traction Co., and only possessed six cars, and their costs were 4·76d. With regard to Cork, there the Corporation had a lighting undertaking in conjunction with the tramways, and the expenses were simply apportioned as between the two concerns. As to Dublin, that was a much larger company, and in the natural order of things they were better able to show lower costs than a small company like the Bath Electric Co., but there it was only 5·03d. as compared with 5·092d. With regard to the local authorities, for the purposes of comparison they had to deduct the directors' fees, management expenses, &c., from the 5·092d., which brought it down to 4·723d., and in only one instance was there a Corporation showing a lower cost per car-mile, and that was Reading. There, however, they had to remember that the topography of Reading was very different from that of Bath. To sum up the figures, it meant that the average cost per car-mile in the case of companies was 6·10d., and that of the local authorities 6·52d., while that of the Bath undertaking was 5·092d., or deducting London expenses, 4·723d. It was, therefore, evident to anyone that their costs were not high as compared with other companies of a similar nature.

The report was adopted.

Berlin Elevated and Underground Railway.

The report of the directors of the Gesellschaft fur Elektrische Hoch und Untergrund Bahnen states that after the transitory standstill in the development of traffic during the generally unfavourable economic situation in 1908, a satisfactory growth of traffic took place on all the lines in the second half of 1909. The increase in the number of passengers by 9,500,000, and of the receipts by £68,000, was due chiefly to the circumstance that the West-End line and the Spittelmarkt line were worked during the whole of the year in conjunction with the other lines, whereas, in 1908, the West-End line was only in operation for nine months and the Spittelmarkt line for three months. During the concluding three months in 1909 the traffic experienced a normal increase, and the progress has continued in the first months of 1910. The accounts indicate the following figures for the past two years:—

	1909.	1908.
Share capital	£2,000,000	£2,000,000
Loan capital	1,998,000	1,998,000
Gross profits	237,000	180,000
Renewals fund provision	33,700	26,250
Taxes to city authorities	8,900	7,410
Depreciation provision	3,380	3,620
Net profits	113,500	92,500
Dividend, per cent.	5	5

The dividend is payable on £1,500,000 ordinary capital and on £500,000, of which one-quarter is paid up. It is mentioned that the level line from the Warschauer Brucke to the Central Vichhof, the working results of which are included in the foregoing figures, was sold to, and at the request of, the city of Berlin on January 1st, 1910. The elevated and underground railway, which has a total length of 11 miles, carried 54,100,000 passengers in 1909, as compared with 44,600,000 in the preceding year, and the average receipts per passenger were 1·58d., as against 1·55d. in 1908. The report also refers to the extensions in contemplation, or in progress, and states that the erection of a second power station has been commenced at Ruhleben, and that a new level line from the Warschauer Brucke to the Frankfurter Chaussee, in Lichtenberg, has been completed as a feeder to the elevated and underground railway.

Newmarket Electric Light Co., Ltd.

The directors' report for 1909 states that during the year 779 8 c.p. lamps were connected to the mains, making the total at the end of the year 24,443 lamps. Applications for a further 442 lamps have been received. The whole of the works have been maintained in perfect working order. The revenue has been well maintained, and although the sale of current is £54 less than in the previous year, there is an increase in the profit of £152, due to the greater efficiency at the works, owing to the additional plant installed towards the end of the previous year. The profit on the year's working, added to £79 brought forward, amount to £2,573, which, after providing for debenture and other interest, £733, leaves a balance of £1,839. The directors recommend the payment of a dividend of £4 per cent.; that £650 be carried to reserve for renewal of plant, and that the balance be carried forward. Messrs. H. J. Garrod and F. E. Gripper offer themselves for re-election as directors.

A Swiss Investment Co.—The Schweizerische Gesellschaft fur Electrische Industrie, of Basle, which is closely associated with the financial group of the Siemens & Halske Co., reports that nearly all the undertakings in which the company is interested experienced slightly improved results during 1909. The gross profits amounted to £97,500 as compared with £91,800 in 1908, and the net profits were £47,100 and £38,000 in the two years respectively. It is proposed to pay a dividend at the rate of 7 per cent. on the paid up share capital of £400,000, being the same rate as in 1908. The bonds in circulation represent £1,200,000 and against these securities stand in the books at £756,000 and syndicate participations at £126,000, whilst debts owing comprise £858,000.

Stock Exchange Notice. — The Committee have appointed April 15th as a special settling day in Rosario Electric Co.—20,000 ordinary shares of £5 each, £1 paid, Nos. 32,001 to 52,000, and have ordered same to be quoted officially.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Mar. 30	2,434	+ 94	43	58,617	— 542	..	..
Ayr	April 2	491	+ 128	46	14,890	+ 34	8	..
Bath	,, 2	1,819	+ 595	13	9,090	+ 1,511	..	..
Belfast	,, 1	8,5?0	+1,299	51	200,575	+ 9,195	37	..
Birkenhead	Mar. 27	2,023	+ 103	51	51,914	+ 388	13·63	..
Birmingham Corp.	,, 26	13,205	+ 441	52	344,604	+14,675	56·4	..
Blackburn	,, 30	2,784	+ 805	½	1,988	+ 579	14·12	..
Blackpool Corp.	April 8	1,080	+ 102	..	57,489	+ 6,585	..	..
Blackpool-Fleetw'd	,, 4	1,629	+1,348	13	4,168	+ 1,049	..	..
Bolton	Mar. 27	5,?03	+1,022	52	120,214	+ 2,582	26	..
Bournemouth	,, 30	3,858	+1,148	52	85,421	+ 3,401	21·96	..
Bradford	,, 26	10,011	+1,412	51	249,052	+12,597	54·81	..
Brighton	April 3	2,091	+ 629	½	853	— 96	9·5	..
Bristol	,, 1	12,8?4	+3,180	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Mar. 25	428	+ 14	12	2,583	+ 78	3·65	..
Barnsley	,, 25	846	+ 25	,,	2,021	+ 131	..	..
Barrow	,, 25	498	+ 118	,,	2,698	+ 861	5·37	..
Cavehill	,, 25	188	+ 14	,,	6?7	+ 25	..	..
Devonport	,, 25	785	- 136	,,	4,755	+ 461	8·85	..
Gateshead	,, 26	1,973	+ 88	,,	11,345	+ 15	11·25	..
Gravesend	,, 25	3?0	+ 28	,,	2,203	+ 158	6·5	..
Greenock	,, 25	1,108	+ 218	,,	6,000	+ 869	7·25	..
Hartlepool	,, 25	429	+ 57	,,	2,418	+ 161	6·72	..
Kidderminster	,, 25	165	— 9	,,	970	+ 43	..	..
Leamington	,, 25	268	— 42	,,	1,660	+ 44	..	..
Merthyr	,, 25	384	— 5	,,	2,215	— 76	2·9	..
Metropolitan	,, 25	14,6?7	+4,252	,,	78,872	+17,600	22	..
Middleton	,, 25	600	+ 16	,,	3,149	— 186	3·5	..
Mid. Joint Com'tee	,, 25	10,9?0	+ 803	,,	64,289	+ 2,964	..	..
Oldham—Ashton	,, 25	1,161	+ 114	,,	6,143	+ 74	9·13	..
Peterborough	,, 25	213	+ 13	,,	1,151	+ 60	5·31	..
Potteries	,, 25	3,484	— 112	,,	20,236	— 79	29	..
Rothesay	,, 25	111	— 21	,,	631	+ 27	2·75	..
Southport	,, 25	508	+ 80	,,	2,673	+ 181	8·17	..
S. Metropolitan	,, 25	1,522	+ 269	,,	8,457	+ 973	..	..
Swansea	,, 25	1,?70	+ 231	,,	11,446	+ 1,364	12·5	..
Tynemouth	,, 25	344	+ 82	,,	1,698	+ 208	3·75	..
Weston-s Mare	,, 25	66	+ 23	,,	?05	+ 19	3	..
‡Worcester	,, 25	484	+ 18	,,	2,786	+ 133	5·75	..
Wrexham	,, 25	199	+ 35	,,	1,045	+ 25	..	..
Yorks. Wool. Dist.	,, 25	1,836	+ 125	,,	10,?91	+ 1,163	17	..
Miscellaneous	,, 25	?96	+ 40	,,	2,235	+ 168	..	..
Burnley	April 2	1,982	+ 568	..	..	..	..	..
Burton-on-Trent	,, 3	524	+ 40	52	13,749	+ 35	6·62	..
Bury	Mar. 27	2,495	+ 474	51½	58,968	+ 516	22·5	..
Cardiff	,, 26	4,101	+ 212	52	112,646	+ 3,140	..	..
†Carlisle	,, 12	155	+ 15	10	1,491	+ 45	..	..
Chatham and Dist.	,, 24	1,459	+ 67	12	8,856	+ 839	14·98	..
Cork	,, 31	922	+ 72	..	5,592	+ 312	9·89	..
Croydon	,, 18	3,144	+ 827	..	79,525	+ 9,917	..	..
Darlington	,, 12	357	— 6	50	9,161	— 509	..	..
Darwen	,, 25	491	+ 46	51	12,539	— 41	4·36	..
Dover	,, 26	462	+ 56	52	10,447	— 77	4·75	..
Dublin	April 1	8,670	+1,033	..	65,217	+ 3,501	54·26	..
Dundee	Mar. 30	2,333	+ 143	45½	5?,585	— 508	15·5	..
East Ham	April 2	2,113	+ 281	52	52,194	+ 6,088	8·62	·77
Exeter	Mar. 31	..	..	52½	15,929	+ 1,056	5·5	..
Glasgow	,, 26	34,738	+1,600	..	732,959	— 9,741	95·62	5
Hastings	,, 31	2,322	+ 933	..	..	..	..	..
†Huddersfield	,, 12	1,674	+ 223	49	82,378	+ 4,918	28·5	·5
Hull	April 2	5,372	+ 889	52	137,181	+ 8,280	14·5	1·5
Ilkeston	Mar. 17	247	+ 2	50	6,601	— 237	..	..
Ipswich	April 3	718	+ 73	52	20,314	+ 709	10·5	..
Kilmarnock	Mar. 26	?71	+ ?5	45	6,514	— 201	4·25	..
Lancashire United	,, 30	3,254	+ 840	..	16 007	+ 1,153	39	..
Leeds	,, 26	18,904	+1,686	51	318,994	+14,924	..	..
Leicester	..	..	..	..	..	..	..	..
Leith	,, 26	1,102	+ 198	45½	26,583	+ 3,205	9	3
Liverpool	,, 19	21,488	+1,748	11½	117,373	+ 4,165	118·5	6
‡L.C.C.	,, 19	7?,578	+16,612	..	1,859,341	+146,659	131·5	9·75
London United	April 2	14,184	+3,671	..	73,421	+ 9,588	..	..
Lowestoft	Mar. 6	102	+ 25	23	3,?58	+ 220	3·5	..
Manchester	,, 26	30,606	+2,478	52	768,039	+ 1,751	183	1
Newcastle	,, 26	7,504	+ 49	..	199,888	— 2,165	14·5	..
Newport	,, 26	1,271	+ 99	52	33,695	+ 561	14·5	..
Oldham	,, 27	3,645	— 80	52	91,794	— 7,291	23·75	..
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	,, 26	3,558	+ 220	51	103,453	+ 4,753	14·5	·75
Preston	,, 30	1,496	+ 141	..	..	..	..	..
Rotherham	,, 3	1,060	— 25	44	26,087	— 992	12	2
Salford	,, 28	9,849	+1,455	51½	235,025	— 59	..	..
Sheffield	,, 30	11,718	+1,063	52	292,220	+ 9,333	39·62	2·62
Southampton	,, 23	1,879	+ 124	51	53,846	+ 760	..	..
Southend-on-Sea	,, 30	1,124	+ 453	52	26,245	+ 4,248	..	..
South Shields	,, 26	1,029	+ 118	51½	28,601	+ 235	..	..
Swindon	..	..	..	..	..	..	..	..
Tyneside	,, 30	1,217	+ 453	13	5,002	+ 220	..	..
Wallasey	April 2	1,887	+ 194	52½	45 871	+ 1,344	..	..
Walthamstow	Mar. 26	1,336	+ 3?4	51½	33,411	+ 2,072	9	..
West Ham	,, 24	4,?44	+ 517	51½	130,009	+ 9,072	15·25	..
Wolverhampton	,, 16	1,702	+ 369	50	42,731	+ 2,417	12·5	1·75
Baker St.-Waterloo	April 2	6,410	— 375	13	44 675	+ 55	4·25	..
Cen. London Rly.	Mar. 26	10,516	— 888	12	66,?76	— 1 295	6·32	·55
Gnar. +, Exc. Hamp.	April 2	7 800	+ 95	13	49,910	+ 215	7·75	..
City & S. Lon. Rly.	,, 3	6,297	— 231	13	43,180	— 982	7·26	..
Dublin-Lucan Rly	,, 1	315	+ 66	13	1,454	+ 71	7	..
G.N. and City Rly.	Mar. 26	2 820	— 259	12	18,888	— 675	3.5	..
G.N., P'y. & Brmtn.	April 2	11,165	— 646	13	74,015	+ 2,810	9·25	..
L'pool Overh'd Rly.	Mar. 27	2,520	+ 55	..	16,623	— 60	6·6	4·3
Llandudno-Col. Bay	,, 25	308	+ 80	16½	2,002	+ 254	..	..
Mersey Railway	April 2	4,137	+ 245	13	25,853	+ 520	4·5	..
Metropolitan Rly.	Mar. 27	31,740	+ 658	..	195 981	+ 6,627	24·5	..
Met. District Rly.	April 2	20 857	+ 960	13	140,390	+12,792	24	..
Anglo-Argentine	1	87.331	+7,187	..	559,542	+45 855	..	..
‡Auckland	March	14,489	+ 783	12	43,988	+ 3,164	29·3	1·38
Bombay (B.E.T.)	Mar. 4	389	+ 15	9	1,612	+ 109	..	..
‡Brisbane	March	17,990	+1,990	..	50,830	+ 5,704	..	..
‡Brit. Columbia Rly.	..	..	..	..	..	..	..	..
† Calcutta	April 2	6.666	+ 130	..	..	..	..	..
‡CapeElectricT.Ld.	..	..	..	..	..	..	..	..
‡Kalgoorlie, W.A.	Feb.	3,185	..	..	6,357	..	20·5	..
Madras	Mar. 31	4,615	+ 231	..	8 288	+ 532	..	..
‡Lisbon	..	..	..	..	..	..	..	..
† Perth (W.A.)	,, 25	3,140	+ 288	..	19,080	+ 1,183	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

INVESTMENT and speculation are both wider awake than they have been for many years past. The boom in Rubber shares has presented the public with profits such as they have hardly known since the century opened, and the avid appetite for buying is apparent even in the long-deserted Home Railway market.

For gambling purposes, the speculator in the latter department has rushed for Districts as eagerly as for anything amongst the lower-priced issues, and the Ordinary stock rose 2½ points before losing half of it. The group, of which the District Railway forms an important part, is much in favour. Underground Electric Railways shares of £10 each, which up till now have been almost unsaleable, came into demand at a guinea apiece, and the Income bonds rose 5 to 41.

It is no part of the scope or intention of these notes to give tips, so no credit can be claimed for the quiet recommendations offered here to pick up those Income bonds when the price was nearer 30. Nevertheless, it is difficult to repress the hope that perhaps one or two readers acted on the hints. The 4½ per cent. bonds of the company can still be bought about 90, at which the return on the money is 5 per cent.

East Londons have developed a most unusual amount of vitality, the Ordinary stock rising to 4½. The four classes of Debenture stocks have gone up to 97, 25, 8 and 6, the last being the "D" Debenture stock, of which there is but half-a-million or so issued.

Metropolitan Consolidated is moving up quietly. Central London Preferred and Deferred stocks are up 1 each. City and South London gained 2. Almost the only shares in the Home Railway list which have not moved are Great Northern and City Preferred, which stick at 15s. for the £10 fully-paid shares. The line, of course, is, and has been, doing badly; the traffics for the current half-year show a decline of about £700, and the competition is as bad as ever. Yet if the market continues in its present bullish temper, it is not beyond the range of imagination to foresee a gambler's chance in these unfortunate counters.

Some investors in electricity supply shares are beginning to grow uneasy at the rise in the price of rubber—the raw material. They fear that the heavy increase must make a difference to profits already suffering from the metal-filament lamp, and other causes. A mere financial writer dare offer no opinion on the reasonableness, or otherwise, of this contention, but may point out that the timid folk do not appear to be selling their shares, if the steadiness of electricity supply quotations be any criterion. Charing Cross and Strand Ordinary and Debenture have improved, other metropolitan descriptions being firm without noticeable alteration. A number of shares and stocks were marked *ex* dividend last account day. Urban Debenture recovered its 2½ per cent. interest, and a point in addition. Victoria Falls Preference moved up a trifle, and the Mexican issues are good.

The rubber boomlet shows as few signs as ever of deflation. Raggedness is naturally perceptible here and there. High-priced shares have shown a tendency to shade away from the best of their highly-exalted values. For the low-priced rubbers, the public demand is incessant. Shares in companies where the underwriters got "landed" have been hoisted of late to substantial premiums, and the renewed stream of new issues fails to quench the thirst for the popular flotation speculations. Not only the world and his wife, but their sons, daughters and servants are engaged in the giddy round, and the unanimous agreement in the fact that somebody will get badly left in the long run makes no difference to the multitude who are content to trust that the hindermost will be everyone but them.

Tramway and traction descriptions of all kind are strong, following the lead of the Home Railway Market. Mexico Trams are 2 up and the bonds ¼. Rios keep about 97½ for the bonds and shares alike. Sao Paulos are 151½. Anglo-Argentine Trams First Preference hardened. London United Debenture is a point better. The feature in this market is the rise to 31 in London General Omnibus stock.

Telegraph and telephone issues have taken a back seat on account of the rubber excitement. American Rails being out of favour, Anglo-American Telegraph Deferred stock has declined, although the Preferred is ¼ higher. Eastern Telegraph stocks are rather better. American Telephone and Telegraph, *ex* 2, is marked six points lower, while New York Telephone 4½ per cents. keep at 100½. Globes are easier, Marconi's 1/32 better.

Manufacturing shares are firm on the whole. Babcock & Wilcox recovered their 1/16 fall of last week, and Castner-Kellner's are good. Telegraph Construction Debenture put on ½, and India-Rubber shares at 15⅜ show a 5s. rise. Callenders lost an equal amount, and British Insulated, *ex* 6s. dividend, were put down 10s. to 7½ middle.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations March 29th.	Closing Quotations April 5th.	Business done week ended April 5th, 1910. Highest	Lowest.	Rise + or Fall −	Present Yield per cent.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	£8	Nil	Nil	Nil	Nil	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	£ s. d. Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$255,196,100	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	143 —145	137 —139 xd	142½	..	..	5 15 1
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	98 — 95	98 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	3⅝%	3⅝%	£3 4s.	3⅝%	59½ — 61½	59½ — 61½	..	..	..	6 1 0
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	102½ —103½	102½—103½	103½	102½	..	5 16 3
3,220,770	Do. do. do. Deferred	Stock	1⅝%	1 %	8/-	25/-	19⅜ — 19¾	18⅝ — 19½	..	..	—⅛	6 9 10
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½ -101½	99½ - 101½	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 1/16 — 8 3/16	8 1/16 — 8 3/16	8½	..	..	4 16 3
2,449,176	Commercial Cable, Sing. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87½ — 89½	87 — 89 xd	..	..	..	a 9 11
16,000	Cuba Telegraph	10	5 %	6 %	6 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅛ — 3⅜	3¼ — 3⅜	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8½	7⅞ — 8⅛ xd	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	20	4½%	4½%	4½%	..	13⅞ — 14⅛	13⅞ — 14⅛	14⅛	..	..	5 16 3
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	136¾ -139¼	137 —140	138½	136¼	+ ⅜	5 0 0
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	8½%	86 — 88	86 — 88	87⅜	..	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	103 — 105	104½	104	+ ⅜	a 16 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	12 — 13⅛	12¾— 13⅛	13½	..	..	5 4 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100½ -102½	100 —103	..	..	+ ⅜	3 17 8
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10½ — 11	10½ — 11	10⅞	10⅜	..	5 4 7
181,127	Do. do. 5 % Pref..	10	6 %	6 %	6 %	6 %	18½ — 18⅞	18½ — 18⅞	18⅝	18⅜	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	29½ - 30¼	29 — 31	30½	29⅝	+ ⅛	6 0 0
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	..	54 — 56	54 — 56	..	..	+ ⅛	5 14 1
$41,880,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	91 — 93	91 — 93	..	..	..	4 11 5
$50,000,000	Do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	80 — 84	78 — 80	..	..	..	4 15 8
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ½	⅜ - ⅝	14/6	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	¾ — 1	¾ — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	½ — ⅝	½ — ⅝	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104½ —106	104 —105½	105⅝	104½	— ⅛	5 13 9
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½ —125½	123½ —125½	124⅛	124½	..	4 15 7
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 10⅝	10⅛ — 10⅜	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅛	10 — 10⅛	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ - 5⅝	..	..	..	4 8 11
2,000,000	Do. do. 5½ % Deb. Stock Red. ..	Stock	5½%	5½%	5½%	5½%	98 —100	98 —100	..	..	..	3 10 0
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	..	1⅛ - 1⅛	1⅛ — 1⅛	..	..	+ ⅛	5 6 8
80,000	Do. do. do. 6 % Cum. Pref....	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	4 14 9
195,155	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
29,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,839	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	131 —134	131 —134	..	..	..	4 9 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7 1/16 — 7 1/16	7 1/16 — 7 1/16	..	..	..	5 7 9
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5 3/16	..	..	4 8 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13⅜ — 14⅛ xd	13⅜	..	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅛ — ⅛	⅛ — ⅛	17/6	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
80,000	Do. do. 5 % Debs., Nos. 1 to 1 800 ..	100	5 %	5 %	5 %	5 %	100½ —102½	100½ —102½	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4⅛ — 4	..	97,6	91/4½	..	5 1 3
500,000	Do. 5 % 2nd Pref., 800, to 1,300,000	5	..	..	..	5 %	4½— 4⅝	4½— 4⅝	94/4½	93/ ½	..	5 5 3
4,465,674	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	90 — 91½	90 — 91½	91½	90½	..	4 7 5
333,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
580,000	Babcock & Wilcox, 1 to 580,000..	1	20 %	20 %	20 %	..	5 — 5⅛	5 1/16 — 5 3/16	5⅛	5 1/16	..	3 19 2
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	⅜ — ⅝	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	1 — 1⅛	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	2¼ — 2½	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	⅜ — ⅝	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	95 — 98	95 — 98	..	..	..	..
600,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	8 %	8 %	8 %	145 —149	145 —149	115	..	..	5 7 5
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	122 —126	122 —126	123½	122	..	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110½—112½	110¾ -112½	111½	110½	..	4 8 11
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	102 —105	..	..	+1	4 5 9
138,801	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	8 %	1½%	..	3 — 3⅛	3 — 2⅞	66/3	63/9	..	4 5 9
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	91 — 94	92	89½	+ 1	5 6 6
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	68 — 73	..	..	..	6 6 8
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	7⅜ — 7⅝	7⅜ — 7⅝ xd	7⅞	..	..	6 15 7
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅜ — 6⅝	6⅜ — 6⅝	6 9/16	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	100	4½%	4½%	4½%	4½%	108 —106	108 — 106	108	..	..	4 4 11
904,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	90 — 94	90 — 94	92	91½	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	3/8 — 5/16	3/8 — 5/16	..	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	49	47½	..	7 16 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref. ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	3⅛ — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 8 0
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	..	4¼ — 4⅜	4¼ — 4⅜	..	..	..	4 14 9
45,904	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅛ — 5	3⅛ — 5	..	..	..	5 0 0
860,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	100	..	..	4 9 1
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10½ — 11	10 — 10⅜	..	..	— ⅛	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅜ — 5½	9⅜ — 9⅝	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	4 6 2
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	2⅛ — ⅜	2⅛ — ⅜	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅜ — 2⅝	2⅛ — 2⅜	52/-	..	+ ⅛	4 15 3
910,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 - 107	..	..	..	4 4 1
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	70 — 72	70 — 72	71	..	..	4 8 4
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	86 — 88	87	86	+1	4 10 11
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	54 — 54	53 — 55	..	..	+1	3 12 9
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	31 — 32	33 — 34	33½	33½	+2	5 2 11
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations March 29th,	Closing Quotations April 5th.	Business done week ended April 5th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
280,000	Dick, Kerr & Co., 1 to 280,000	1	10 %	10 %	6 %	..	7/8 — 1	7/8 — 1	..	..	..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 3/32 — 1 5/32 xd	..	..	..	5 4 4
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	2½%	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4½%	2½%	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	..	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	79 — 82 xd	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/2 — 5/8	1/2 — 5/8	6/3	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 7/8 — 8 1/4	7 7/8 — 8 1/4	..	..	..	6 1 8
210,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	84 — 88	82 — 86 xd	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	1/2 %	Nil	..	3/8 — 7/8	3/8 — 7/8	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10 1/4 — 10 7/8	10 1/4 — 10 7/8	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 — 103 1/4	102 —103 1/4	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12 3/8 — 13 3/8 xd	12 3/8 — 13 3/8	..	..	..	5 18 6
40,000	Do. do, 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5 3/8 xd	5 — 5 3/8	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½—107½	105½—107½	..	..	..	4 3 9
60,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10 %	10 %	10 %	10 %	15½— 16	15¾— 16¼	15½	..	+ ¼	6 3 1
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	¾%	Nil	Nil	1 1/16 — 1 1/8	1 — 1 1/16	..	..	— 1/16	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	4 3/4 — 5 1/4	5 — 5½	..	..	+ ¼	9 1 10
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	Nil	..	1¼ — 2½	1¼ — 2½	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1¼ — 2½	1¼ — 2½	..	..	..	Nil
195,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3¾%	..	2 3/8 — 3 1/4	2 3/8 — 3 1/4	60/-	..	..	11 10 10
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	..	4 %	4 %	70 — 73	71 — 74	74	73½	+1	5 8 1
5,782,063	Metropolitan Consolidated	100	1 %	¾%	¾%	1 %	44¼ — 44¾	44⅜ — 45¼	45¼	45⅛	+ ⅛	2 4 2
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	68 — 70	68 — 70	69	..	..	3 18 7
8,285,000	Do. District	100	Nil	Nil	Nil	Nil	21⅜ — 22½	22⅛ — 23	23⅜	23⅛	+ ⅜	Nil
891,887	Metropolitan Electric Trams., Ord.	1	..	..	4¼%	..	1/8 — 1/4	1/8 — 1/4	..	..	..	6 10 11
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	9d.	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/8 — 1/4	1/8 — 1/4	14/9	14/4½	..	6 3 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	95⅝	94⅝	..	4 10 11
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	..	132 —134	133 —135	..	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	94½ — 95½	94⅝ — 95⅝	95½	..	..	5 4 9
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 1/8	1/16 — 1/8	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
87,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	34 — 35½ xd	34 — 35½	..	..	..	5 16 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 19[illegible]	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	102 —103	102½—103½	..	..	+ ½	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	89 — 91	89 — 91	90¾	89½	..	4 18 4
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	35 — 37	40 — 42	41⅜	37½	+5	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/8 — 3/8	1/8 — 3/8	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	5	..	6 %	6 %	3 %	1½ — 2¼	1½ — 2¼	..	..	..	1 4 2
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	..	4¼ — 4⅜	4¼ — 4⅜	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7⅜ — 8¼	7⅜ — 8 xd	7½	..	..	6 5 0
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7¼ — 7⅜	7 — 7½ xd	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	99 —102	100 —103	..	..	+1	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½ xd	4 — 4½	86/3	8 /-	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 4⅝	4½ — 4⅝	..	..	+ ⅛	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8⅞ — 4⅝	8⅞ — 4⅝	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96⅛ — 98⅛	97 —100	..	..	+1	4 0 0
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	8½ — 4 xd	8½ — 4	78/9	..	..	5 12 6
176,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11⅞ — 12⅜	11½ — 12 xd	..	..	..	5 16 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13⅛	12 — 13 xd	12⅝	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1/2 — 2	1⅛ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	3 — 3⅜	2⅞ — 3⅛ xd	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—40,000	10	6 %	6 %	6 %	6 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 3 1
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛ xd	10⅜ — 11⅛	..	..	..	5 7 10
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4⅓%	100 —103	100 —103	101½	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1½ — 1¾	1½ — 1¾	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	71 — 74	72 — 75	72½	..	+1	6 0 0
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	80 — 83	83 — 86	..	..	+3	5 16 3
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 4½	4⅜ — 4⅝ xd	..	..	..	6 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛	4⅝ — 4¾ xd	..	..	..	4 15 3
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	93 — 96	..	..	— 2	4 13 9
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7½	7 — 7⅝ xd	..	..	..	5 13 4
$1,976,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½—104½	102⅜—104½	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7½ xd	7 — 7⅝	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94⅜ — 96½	94⅜	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝ — 2 xd	1⅝ — 2	36/3	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	..	4⅜ — 5⅜ xd	4⅜ — 5⅜	97/6	..	..	5 11 8
982,858	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	..	..	..	4 5 1
900,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6¾%	5 %	5 %	4 — 4⅛ xd	4 — 4⅛	82/6	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4⅜%	4⅜ — 5	4⅜ — 5	..	..	..	4 10 0
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	..	..	..	4 1 6
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84¼ — 85¼	84⅛ — 85⅛	85¼	85	..	5 16 3
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	81½ — 83½	81⅛ — 83⅛	82½	82	..	4 3 10
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	104 —106	103⅛ —105⅛	104½	104	— ⅛	6 12 8
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds	100	..	..	5 %	5 %	90 — 91	90¼ — 91½	91½	91	+ ½	5 9 7
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb	100	4½%	4½%	4½%	4½%	96⅛ — 98⅛	96⅛ — 98⅛	..	..	..	4 11 5
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½%	..	4¼ — 5	4⅛ — 4⅜ xd	..	..	..	2 15 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅛ — 5	4⅛ — 4⅜ xd	..	..	..	5 6 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 —101	99 — 101	100	..	..	4 19 0
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅜ — 12⅜ xd	11⅜ — 12⅜	..	..	..	5 9 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6¼ — 6⅜ xd	6¼ — 6⅜ xd	..	..	..	5 3 8
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
119,694	River Plate Electy. Co. Ord. Nos. 1 to 120,507	1	2½%	6 %	8 %	..	1⅛ — 2⅛	1⅛ — 2	£9/-	8?/-	— 1/16	4 0 0
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅜ — 1 7/16	1⅜ — 1⅜	..	..	..	4 16 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	102¼—104½	102¼—104½	..	..	..	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8¼ — 9	8⅜ — 8⅝ xd	..	..	..	5 14 8
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅜ — 7¼	6 — 6¾ xd	7¼	..	..	5 7 8
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ — 2⅜	1⅜ — 2⅜	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	5 %	2⅜ — 3 xd	2⅜ — 3	..	..	..	6 13 4
150,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	100¾	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	7/8 — 15/16	7/8 — 15/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8 xd	1 — 1 1/16	..	..	— 1/16	6 4 5
234,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	98 —101 xd	98½	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1/4 — 1	1/4 — 1 xd	..	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅛ — 2¼	1⅛ — 2 xd	..	..	..	10 10 6
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	78 — 82	79 — 81 xd	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/16 — 7/16	1/16 — 15/16	17/3	..	+ 1/16	5 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8½ — 9	8⅝ — 9	8 15/16	8 11/16	..	5 11 1
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1908)	5	4½%	4½%	4½%	4½%	4⅜ — 5⅛	4⅜ — 5⅛	5⅛	..	..	4 8 9

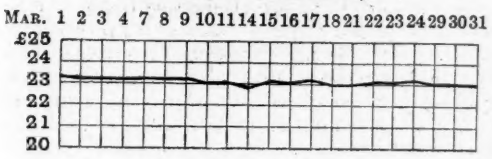
* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., March 17th, 1910.

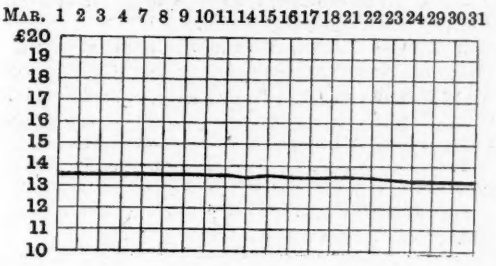
METAL MARKET.

Fluctuations in March.

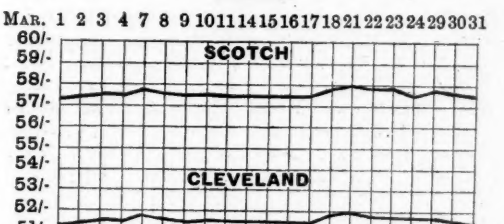
SPELTER (G.O.B's.).



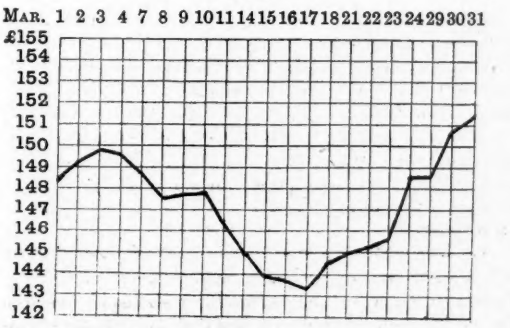
LEAD (ENGLISH).



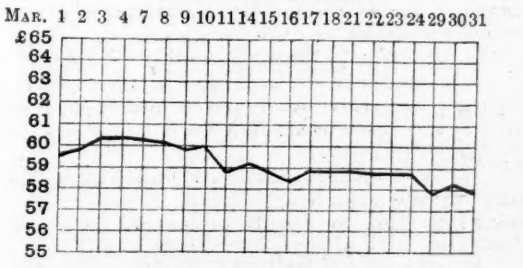
IRON.



TIN.



COPPER (G.M.B's.).



Perth.—While the T.C. has agreed to concede the tramway employés a day off duty in lieu of Sunday work, it has decided that there shall be no increase of wages except in the case of men at present in receipt of under 20s. per week. The working hours are not to exceed 60 per week, and for extra labour time and half will be paid. The Sunday service was inaugurated on April 3rd.

FOREIGN COMPETITION: ITS GROWTH AND EFFECTS.

By W. O. HORSNAILL, A.M.I.Mech.E., A.M.I.E.E.

Up to about the middle of the last century this country was leading the world in the initiation and development of new inventions and the output of machinery, foreigners being compelled to purchase these products from the British maker or merchant. Such a state of things could not possibly have been expected to continue; it was inevitable that other nations, which possessed the necessary supplies of raw material, should attempt to manufacture for themselves, the result being a slower growth in our export trade until, in some cases, such as the production of steel, even our *output* has diminished. Demands for machinery will always exist in certain countries lacking the requisite mineral deposits, and so long as we can hold our own in these markets we need not fear foreign competition at home, natural and other conditions being particularly favourable to a low cost of production in this country.

It is customary to think of the loss of the monopoly in certain manufactures as being confined to British industries. Such is not the case, although, England having once held the lead, it is only natural that this feature should be more prominent in this country than in others which have taken up manufacturing more recently. Two examples may be quoted in support of this contention, viz, the manufacture of incandescent gas mantles, which was at one time entirely in German hands, but is now being carried on in England, France and the United States; and the cultivation of the sugar beet, for which arrangements are now being made in Lincolnshire.

It is doubtful whether any nation will ever again hold the monopoly in any industry unless favoured by exceptional natural conditions, the tendency being for manufactures to distribute themselves amongst all countries possessing the raw materials.

In the early stages, the taking-up of the production of machinery by other countries made but slow progress, owing to the lack of technical literature and education. The knowledge of special crafts in those days mainly consisted in experience; hence foreigners who wished to establish British industries in their midst could only do so by importing British workmen to train the native employés, or by sending the latter over here to learn the trade in our workshops, the experience thus obtained being subsequently imparted to their countrymen. Then, again, the extent of the knowledge required was far greater than at the present time, a seven years' apprenticeship being found none too long in which to acquire the necessary experience; in fact, so great was the requisite skill in some industries that heredity exercised an important influence upon competency.

So long as these conditions obtained, the development of foreign manufacturing was exceedingly slow, and for many years British machinery remained superior to the products of American and Continental workshops. As time went on, however, the conditions changed; technical literature and education were introduced, and the spread of machine tools did away with the need for the experience and skill of the old-time mechanic, with the result that what had hitherto been exclusively British industries were much more easily established in foreign countries.

That other nations should be able to compete with us in the manufacture of machinery to supply their home markets does not necessarily reflect adversely upon British enterprise. On the other hand, it might fairly have been predicted that we should have retained the ascendency in the matter of new inventions, and their development into new industries, whilst our products would have dominated the market in those countries which could not attempt to manufacture for themselves.

A study of our patent records leads to the conclusion that as regards inventive skill, we have little to learn from the foreigner, but when the very small proportion of inventions which have been developed is considered, our faith may well be shaken. It would appear that we still have the inventive faculty, without the grit and perseverance required to bring

our ideas to a successful issue. Moreover, of late years, foreign manufactures have found a ready sale in markets in which at one time British goods were exclusively purchased.

Among the first indications that other nations were seriously menacing our leadership in engineering matters were the wood-working and machine tools which reached this country from the United States. These appliances showed evidence of great ingenuity, and although at first the British workman and manufacturer refused to adopt them, they eventually established a market for themselves owing to their undoubted superiority over the home product.

Since the appearance of these American tools this country has, to a large extent, ceased to take the initiative in the development of new machinery, although the British manufacturer has been quick enough at imitating and improving upon foreign products after they have made their appearance over here. It would seem that little short of the threatened extinction of one of our industries by foreign competition is sufficient to induce any improvement in designs and methods on the part of the home manufacturer. Once our makers are awakened to the danger, however, development is very rapid, imitation being quickly followed by improvements until the foreign goods have been ousted. This cycle of effects has occurred time after time as regards American competition, both in engineering products and in other industries. For instance, some 10 or 15 years ago no machine shop could be considered up to date which did not contain a number of American tools. This state of things has now been completely changed, and better machines can be obtained from British makers than any produced in the United States. At the same time there can be no doubt whatever that the improvement in the British product was brought about by American competition, and that, to a large extent, we have imitated their designs and manufacturing methods.

In the development of electrical machinery, some important features in steam engines, and the application of the internal combustion motor to road traction, the Continental manufacturers were well ahead of us at one time, and it is doubtful whether we have yet quite regained our lead in these matters, whilst as regards large gas engines, airships and aeroplanes we are still distinctly behind our rivals.

It must be remembered that the above mechanical contrivances were all invented and developed up to a certain point in this country, to be subsequently imitated and improved upon by foreign experimenters and manufacturers.

All these considerations lead towards the conclusion that British industries suffer more from lack of incentive than from the want of ability, and it will be of interest to study the causes which have enabled our rivals to outstrip us in this direction.

These causes, which are separately considered below, may be roughly enumerated as follows:—

1. Adverse legislation.
2. The discouragement of the inventor.
3. Inferior technical education.
4. High wages and the fair wages clause.
5. Financial factors.
6. High railway rates and costly facilities.
7. Inferior organisation and standardisation.
8. The unsympathetic attitude of our Government.
9. A general devotion to sport and the use of alcohol.

1. *Adverse Legislation.*—It is common knowledge that the electrical and motor-car industries suffered in their early stages from unfair legal restrictions, and, in addition to these drawbacks, electrical developments have been retarded as regards the public supply by legal formalities. It is not contended that the latter are either injurious to the country as a whole or unnecessary, but they have certainly delayed development when compared with the simpler procedure pursued in other countries.

2. *The Discouragement of the Inventor.*—Under this heading our patent laws naturally claim some attention. It cannot be denied that our chief commercial rivals—Germany and the United States—have adopted regulations regarding patents which have in some respects proved more satisfactory than the procedure followed in this country.

The patents granted in the countries above mentioned claim to be some guarantee of validity, a search for priority being made by the patent office both through their own records and amongst other sources of information. This investigation has some effect in lessening the risk of litigation which is so prominent a feature of the British patent system. The English patentee never knows whether his patent is valid or not until action has been taken for infringement and a decision has been given in the higher courts, actions of this nature being very costly, whether successful or not, owing to our system of taxing where costs are allowed. This feature depreciates the value of British patents and increases the difficulty experienced by patentees in getting their inventions taken up, as the manufacturer has to consider the risk of having to institute or defend a costly action for infringement. The cost of obtaining a patent and the period over which protection is afforded in this country also compare unfavourably with these features in some others, but it is doubtful whether the difference is sufficiently great to exercise any considerable effect.

Other factors tending towards the discouragement of the inventor are the unsympathetic attitude of the British manufacturer and the general conservatism of the consumer. The manufacturer is, no doubt, influenced by the considerations set forth above and also by the aforesaid attitude of the consumer. Then, again, as regards labour-saving devices, the incentive towards their adoption is greater where wages are higher, as in the United States; hence American inventions of this nature more easily obtain recognition.

The reluctance of the consumer to adopt new machines and appliances may be traced in some measure to the partially developed designs which have been foisted upon him in the past, our engineers having experimented at the expense of their customers, instead of perfecting new inventions before placing them on the market. This feature is far less common now than was the case a few years ago, British firms having largely adopted the methods pursued by their foreign rivals. Then, again, new designs were often worked out in this country by executive officers whose time should have been fully occupied by their legitimate duties, American and Continental manufacturers having long since given up these methods in favour of development in experimental departments under the supervision of highly trained experts.

3. *Inferior Technical Education.*—There is no denying the fact that several other nations were at one time far ahead of us in this matter, and it is doubtful whether we have yet reached their standard.

4. *High Wages and the Fair Wages Clause.*—Wages are generally lower on the Continent, and the hours are longer; on the contrary, labour is more costly in America than over here, but as we shall attempt to show later, American competition is not of a very serious order. The "fair wages clause" in the contracts with public bodies has undoubtedly given undue advantage to foreign tenderers who are not held to these provisions.

5. *Financial Factors.*—The assistance given to enterprise by foreign industrial banks has been so extensively discussed recently in the technical Press, that it need not be considered here beyond stating that British bankers do not assist their clients to the same extent. British banks as they exist to-day differ from the Continental industrial banks which concern themselves very actively with commercial and manufacturing firms and their undertakings.

6. *High Railway Rates and Costly Facilities.*—Railway rates are far lower for our competitors, and much more use is made of canals with their low freights on the Continent than over here. Furthermore, facilities in the way of private sidings are less costly.

7. *Inferior Organisation and Standardisation.*—As regards both of these matters we are rapidly coming up with our rivals; in fact, as regards organisation, many British engineering works compare favourably with any to be found elsewhere, but it is doubtful whether this excellence is so widely spread as in the United States and on the Continent.

8. *The Unsympathetic Attitude of our Government.*—Few will deny that several foreign Governments assist their national industries through the Consular Service and in other ways to a far greater extent than is the case in this country.

9. *A General Devotion to Sport and the Use of Alcohol.*—The devotion to sport in moderation is undoubtedly a good feature, and it is probable that we gain as much as we lose

in this way, at any rate as regards the workmen and office staffs. There is, however, a tendency amongst principals and others in responsible positions towards devoting too much time to recreation, resulting in the neglect of their duties. Alcohol is admitted to be bad for brain workers, and its too free use by those engaged in bodily labour reduces their productive power. In this matter our foreign rivals, who are more moderate, have a distinct advantage.

The list of causes in favour of the foreign manufacturer would scarcely be complete without some reference to the compulsory military training prevalent amongst our most successful competitors. Habits of obedience and cleanliness are formed during the period of national service, which remain throughout a workman's industrial career, and undoubtedly such factors make for efficiency. On the other hand, originality is discouraged, the result being that whilst the Continental workman is well suited to perfect organisation with a consequently large output, he lacks initiative and inventive skill. These features, however, make for success so long as a sufficient number of inventors can be found to initiate and develop new appliances and improved methods of manufacture.

In spite of the advantages enjoyed by our competitors in the directions considered above, a review of the actual facts shows us that the British manufacturer is quite capable of taking care of himself excepting where the natural conditions are against him. In other words, given a cheap supply of raw material and power, we have nothing to fear from foreign competition. On the other hand, where cheap power and raw material exist alongside each other in a country having a market for the manufactured product, we cannot hope to compete in the long run, as such conditions will induce the establishment of local factories, unless the climatic conditions are of such a nature as to increase the cost of labour.

Hitherto, for instance, we have been able to manufacture iron and steel at a lower cost than other countries owing to the proximity of our iron ore and coal deposits; in future, if the electric furnace should prove a commercial success, the close combination of water power and raw material will introduce serious competition in the making of steel, and, possibly, in the production of pig-iron.

It is impossible for our manufacturers to hold their own in foreign and colonial markets if natural conditions are against them, and the home demand can only be preserved in such cases by imposing a high tariff on the manufactured goods from abroad, otherwise decadence is likely to follow as in the case of sugar refining, silk weaving, and several other British industries. Whether it is advisable to bolster up certain manufactures in this way is a question which cannot be discussed in this article.

For the manufacture of machinery and metal appliances of all descriptions, the home manufacturer, being favoured by natural conditions, has either already ousted the foreigner, or is in the act of doing so.

American competition does not now demand serious attention, further than to keep an eye upon any new developments which are taking place. Experience shows us that American goods have never gained more than a temporary footing in this country, our manufacturers having been stirred up by their appearance to strenuous efforts towards improvement, which have enabled them to successfully compete. One prominent exception, however, to this rule, is the cash register, which does not yet appear to have been equalled by any similar British product.

At the same time, it must be admitted that we have freely copied American methods, but we have also improved upon them until our best factories are now better organised and equipped than any in the United States.

The Americans show a strong tendency towards useless complexity in their systems of control and for obtaining prime cost, British methods being much simpler, and no less effective. So long as our designs and methods can be kept ahead of those obtaining across the Atlantic, we need not fear American competition, either at home or abroad, provided as regards the latter, that we show equivalent enterprise in the exploitation of the foreign markets.

Competition from Continental nations has been much more difficult to meet, particularly in the case of Germany, from whom we import in considerable quantities, gas and oi engines, electrical apparatus, machine tools, ball bearings, and other appliances. German manufacturers certainly have no advantage over us as regards natural conditions, and where our progress in designs and manufacturing methods has kept pace with theirs, we can easily hold our own. It has even been stated that owing to the lower cost of materials and equipment in this country, we can successfully compete in the German home market for certain classes of machinery, this contention being supported by our export statistics. Provided that the lower cost of our materials and plant counterbalance the lower wages obtaining on the Continent, German machinery should find no market over here, and we ought to be able to compete with it in the markets of the world.

The fact that the Germans can, and do, sell gas engines, electrical apparatus, &c., in this country at a lower price than we can make them for, is proof of the inferiority of our designs and methods; furthermore, successful German competition in foreign markets equally implies a lack of enterprise or ability on the part of the British manufacturer and merchant. There is no escape from these contentions; even the plea that our products are of a better quality fails if the consumer will not buy them. The market for low-priced goods of inferior quality is just as profitable as that for the higher class products, and it is much more extensive. The failure to satisfy the demand is no less a failure, because the quality is above the requirements.

As regards the home market the imports of German machinery are decreasing, and there is strong evidence to show that the British manufacturer is rapidly recovering lost ground.

In the foreign market, on the other hand, our goods are too often unsuited to the local demand, whilst our representatives lack the adaptability and persistence of their Continental and American rivals. Furthermore, the catalogues issued by British firms do not always meet local requirements as regards language, measures and weights.

In conclusion, there would appear to be no cause for despondency regarding the future of the British engineering industry. Natural conditions are in our favour, and we have both the inventive ability necessary to progress and the capital and labour required for cheap production. Furthermore, it has already been fully demonstrated that our manufacturers can oust foreign machinery from the home market, whilst they should be able to secure a large proportion of the trade done in countries unable to meet their own requirements in this direction.

CONDENSING.

By W. H. BOOTH.

To the steam engineer it is a constant subject of wonder that the condensation of steam is so exceedingly rapid. An engine is exhausting its big cylinder full of steam in rapid series into a condenser, on which is fixed a pressure gauge, yet the finger of that gauge hardly moves. With a fairly good degree of vacuum, a pound of steam will measure 150 cb. ft. The exhaust valve may open the cylinder to the condenser at a terminal pressure of 15 lb., but the drop to 2 or 2½ lb. is almost instantaneous. For this rapid drop to occur the bulk of the steam must have been promptly destroyed.

It is best to regard steam from the standpoint of the kinetic theory of gases, because it then becomes easier to understand what does actually take place. The molecules are rushing to and fro in the cylinder, and bounding back from every confining surface. One surface is the exhaust valve. This surface is suddenly removed, and out rush the no longer resisted molecules at 1,800 ft. per second. They meet with no resistance to drive them back, and they rush onward to the condenser, and perish of cold.

Within the possibilities of the temperature, all the molecules will thus escape, and so long as the condenser is unable to afford a bounding-back abutment, all movement will be to the condenser. Hence the mistake of making steam enter at a point, instead of over a larger area.

Many tubular surface condensers take in steam at one end of their tube surfaces and directly athwart of the tubes. A better system is to let in the steam by way of a hood over the one end of the tubes, such hood extending backwards to the other end, but gradually tapering down. The steam enters parallel with the tubes, and is spread over all the length of the upper row, and this exposes the steam to a large surface.

Some engineers are apt to assume that the volume of the steam as it travels to the condenser is that of steam at the pressure of exhaust opening, but this is not quite a correct view, for so soon as the exhaust port opens, the pressure appears to drop, and if the pressure has dropped, the steam volume must be 150 cb. ft. per lb., or thereabouts. At least this is the volume which must travel to the condenser for each pound of steam, and since the rate of flow cannot exceed that proper to the molecules at the assumed temperature, it follows that the inlet must be based upon a flow much less rapid than the rate of flow of atmospheric steam kinetically considered.

It is not sufficient to assume the molecular velocity of steam as the rate at which flow will take place. The volume per pound ought to be assumed as, say, 150 cb. ft., and the molecular velocity taken for a temperature of say, 120° F. With these two figures the minimum area of opening to the condenser should be worked out, and an allowance of not less than 40 per cent. should be made. Unless this be done it will be found that there is too large a difference between the cylinder vacuum and the condenser vacuum, for it is easy to have a good vacuum in the condenser and yet for the steam to be throttled all the time at its entry to the condenser.

Much is said about the benefit of high vacua in turbine work. This benefit is largely one of construction, for there is nothing to act as an obstruction to the flow of steam. The cylinder end is opened full to the condenser, and the molecules are not driven back or allowed to bound back from obstructive surfaces placed across their path. But, calculated on the volume at the vacuum pressure, the velocity of flow will be found to be enormous, and many condensers will hardly bear calculation on this basis. But it is here suggested that it is a correct basis on which to expect results.

The molecular velocity of steam at 0° C. was given by Clausius at about 600 metres per second, and it increases as the square root of the absolute temperature, so that at 120° F. the velocity would be about 654 metres per second. With such velocities unimpeded it is easy to see why, when there is a direct flow to a cold condenser, steam so quickly leaves a cylinder vacuous; and it is equally clear that as the vacuum is more intense, the area for steam to flow in must be greater, because there is so much bulk to dispose of.

An examination of an indicator diagram with careful measurement of the rate of drop of pressure, and of the time occupied, would enable a fairly exact calculation to be made of the velocity of flow at each instant into the condenser. The first rush is made by steam measuring only 25 to 45 cb. ft. per lb., but the last escaping steam into a first-class vacuum measures over 300 cb. ft. to the lb., and being colder has a less molecular velocity, and it must not be overlooked that to get maximum power from vacuum this must extend to the piston face. That is to say, though a cylinderful of steam goes to the condenser each half-revolution of the crank-pin, the flow cannot be spread over the whole time of such half-revolution.

It is desirable in the interests of efficiency that it should take place during the small angular movement of the crank just before and after the dead point. Allowing, as is usual, an average rate of condensation of 10 lb. of steam per hour per square foot of tube surface, this cannot be regarded as anything but a working rule; it does not represent fact, for the fact is that steam is killed instantly, and the 10 lb. per hour is condensed in a mere fraction of the hour represented by the sloping toe of the indicator diagram.

Much has been written during the last few years by a new school who deny the accepted theory as to cylinder condensation. It demands a belief, they say, in an impossible rate of condensation, and the 10 lb. per hour bogey is employed as an argument. Very little consideration of the exhaust toe of the diagram, and of the kinetic theory of steam or other gases, and observation of a condenser pressure gauge, should be sufficient to demonstrate the fallacy of the new belief which has so little fact or reason to support it. And the same considerations will serve equally to show the need for the free-est possible or practicable exhaust passages to a condenser.

What is badly needed to-day is experimental trials of surface condensers, with various rates of circulation-water flow, and fed continuously with all the steam they can condense. It is held by some engineers that the capacity to do duty of a condenser is likely to be better when steam comes to it from a high-speed multiple cylinder engine than when it comes from a large slow-moving engine, the condenser of which must deal with a big rush of steam. It is doubtful if there is much or anything in this view, for with the slow engine there is a proportionately long time to deal with the exhaust before and after the dead point, and there is more time for the circulating water to act in producing thoroughly cold tube surfaces for the rush of steam to meet.

Condenser proportioning has been all a matter of empiricism, for there is no theory in the allowance of 6,000 ft. per minute for the mean rate of flow to a condenser. This figure may be correct on a certain assumed basis, but it is a mere fraction of the real velocity of steam, and simply means that the exhaust pipe has to be so big that the steam will reach the condenser in a time too brief for notice. Were the whole period of half a revolution available, it would be possible to use very small exhaust pipes.

But vacuum in a condenser is not what engineers want. It is the equally good vacuum in the cylinder that they are after, and to get which the cylinder must be freed of its contents in a small fraction of a second. But though the condenser will thus instantly destroy steam, its mean rate of work must be very much less, for the limiting factor is not surface action but the rate of heat transmission through the thin tube walls to the water.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"G. R. M." writes:—"1. On the local tramway route, from A to B is 1d. stage, from B to C is 1d. stage, from C to D is 1d. stage, from B to D is 1½d. stage. I mount the car a few yards before B and leave a few yards over C, and the company compel me to pay 2d. Now, as I can go another ¼ mile further for 1½d. if I mount at B, can they legally compel me to pay the 2d., seeing that I do not go so long a journey as those who pay 1½d.?

"2. Recently the company have started a parcel-carrying business in connection with the tramway service, and are endeavouring to compel all passengers to pay for parcels, &c., taken on the car with them. They say that only 28 lb. personal luggage is allowed free, and that they are compelled to take without charge. Could you tell me what constitutes personal luggage? I contend that if I send a workman with a small basket (which could be placed on the knees of the passenger) of lamps, shades, &c., or even his tools, so long as the 28 lb. is not exceeded, that is his personal luggage just the same as a parcel of grocery is a lady's personal luggage. The lady is allowed to pass, but my man has to pay 2d.

"I may say that I have appealed to the manager, and he says the charges made are quite correct."

*** The tramway company are probably working under powers conferred upon them by some special Act of Parliament, together with the general powers conferred upon them by the Tramways Act, 1870. In these circumstances, it is competent for them to make such rules and regulations as appear to them to be proper with regard to fares, provided they do not exact more from the public than the maximum statutory charge—1d. per mile, or whatever it is. "G. R. M." is entitled to exercise all the privileges which may be exercised by any member of the public. So long as the tramway by-laws do not show any undue preference to any person or class of persons, they may be enforced.

With regard to carriage of parcels, no doubt this duty is undertaken by the tramway company pursuant to some power contained in their Act of Parliament, and in order to see whether they are complying with the Act it would be necessary to see the terms of it. As to what constitutes "personal luggage," there is no reported case of this question being answered in relation to a tramway, but it has often arisen in connection with railways. It has been decided that the packages of samples taken round by a "drummer" are not personal luggage; nor does a bicycle come under that head.

PROCEEDINGS OF INSTITUTIONS.

Short-Circuiting of Large Electric Generators, and the Design of Turbo Field-Magnets for A.C. Generators, with Special Reference to Large Units at High Speeds.

(*Discussion on papers read by* Mr. M. Walker *before the* Institution of Electrical Engineers, *London, March 10th and 17th*, 1910.)

Mr. W. A. Chamen, in opening the London discussion, referred to his experience with a 3,000-kw. alternator designed by the author, which had been subjected to several short-circuits, with no ill result. Still, the fact that 1-in. diameter studs had been bent, and coils displaced, raised the question of clamping and showed that this matter was not quite settled. An earlier short-circuit experience of his was the bending and festooning of bare copper strip in conduit all along a Glasgow street. With the later-installed lead-covered cables laid on shelves, this did not occur, probably due to the cables being concentric.

Prof. S. P. Thompson said that not many engineers had the chance of testing their machines in the works on short-circuit, or of publishing the results obtained. The field magnets having no time to become demagnetised, explained the 20 or 30-times increase in current on short-circuiting. The author had shown how much nearer the ideal was the peripheral pole winding than the salient-pole winding. It was interesting to note that the duty of a rotor increased as the cube of the diameter, but only as the increase in length. It was possible to cure ripples in waves, due to pole construction, by arranging the slots in the armature and rotor slightly out of parallel.

Mr. H. M. Hobart mentioned that he had tested machines with solid cores and laminated pole shoes, and found results, as regarded current rise on short-circuit, in opposition to those obtained by the author, but the machines were 20-pole slow-speed ones. The phenomenon was new to him only a few years ago. The tests occurred in 1904, and the machines were specified to stand short-circuiting at the terminals without displacing the windings. What struck him most was the time required for the current to fall to the normal after short-circuiting.

Mr. Cooper said certain windings were peculiarly adapted for open slots, and the question of open or closed slots was of importance owing to the generation of ripples. The forged steel rotor had been much developed in America, where an exceedingly rigid construction and more space for the end connections, especially in two-pole construction, had been obtained by cutting the shaft and forging one half of the rotor on to each portion, or alternatively by using a solid central rotor forging, with large non-magnetic flanges on either side (shielding the windings) which were cast solid on to the ends of the main shaft. The separate portions of the rotor were clamped together by heavy through bolts; this construction enabled a much higher speed to be used, and was many times stiffer than the "through shaft" type. Some 3,000-kw. machines running at 3,600 r.p.m. were in use; they were, however, larger than with laminated field construction with slots in the periphery.

Mr. A. H. Law said there was very little to criticise in the papers. He thought Mr. Chas. Brown should have the credit for the barrel type of rotor with a more or less distributed winding; he took out a patent in 1901, and a Brown-Boveri rotor of this type was in use at the Neptune Bank station, Newcastle, which was built in 1902. The design of barrel type rotors closely followed that of the old single-phase revolving armature. In conjunction with the supply companies' engineers, Messrs. Parsons had carried out some short-circuit tests on one of the 4,000-kw. turbo-alternators at Carville. This machine was twice short-circuited at full voltage (5,800), and the current rose to 7,000 amperes almost instantly, requiring four seconds to fall to a normal value. It was found that the end coils had moved $\frac{1}{32}$ in. Skeleton cast-iron clamps were used and found satisfactory, but for the sake of security these were to be replaced by similar clamps of steel. He thought the importance of keeping down the short-circuit current had not been sufficiently appreciated. The author's special slot introduced disadvantages as well as advantages; it certainly increased self-induction, but this could be done in other ways. Messrs. Parsons used closed slots, as this limited the short-circuit current and gave greater support to the coils. The author's system of compounding, as well as Messrs. Parsons's arrangement of compounding with an exciter, offered a good method of keeping down short-circuit current. The latter firm had recently designed a 1,500-kw. 3,000-r.p.m. machine, in which the short-circuit current should not exceed 14 times normal full-load current, instead of 30 times in the ordinary way. As regards the effects of short-circuiting on direct-current machines, they had had an accidental short-circuit on a 600-kw. turbo set, and this had resulted in pulling up the armature so suddenly that the commutator turned another half revolution before coming to rest.

Dr. M. Kahn described a method employed by the Brush Co., of clamping the end windings of turbo-armatures (arranged in a layer) between two circular flanged rings bolted up to the stator, an arrangement which provided a neat and compact construction. The problem of short-circuits was a difficult one for the end windings, owing to the insulating material, which had to be clamped rigidly. The conductors must not only be clamped to the core, but also stayed against one another by packing pieces, especially the portions of coils in mica tubes, which latter would deteriorate with continued bending. He drew attention to the advantages of the asynchronous machine for large turbine work.

Mr. J. H. Rider said he had experienced two short circuits in connection with the L.C.C. Greenwich plant; in one case, that of a 3,500-kw. slow-speed alternator, with unsupported end coils, the latter practically all collapsed inwards, breaking the mica insulating tubes; in the other case, a 5,000-kw. Dick, Kerr turbo-alternator coupled to a turbine with 16-in. bolts, the latter were sheared cleanly, as by a knife, and he thought this gave a good idea of the stress which occurred when a large machine was short-circuited. However, not a single coil or clamp on the alternator was disturbed, and the machine was put direct on load when the bolts had been replaced. The simple end clamps used on this machine were shown by the author (fig. 18, page 495), and in view of their behaviour, he would like to know whether the numerous clamps provided on the new Westinghouse machines were required. A disadvantage of the cylindrical field was the necessity of using additional fans for ventilating; he asked whether it was a fact that a cylindrical field required more excitation than a similar salient-pole field. Certainly the Westinghouse plant at Greenwich took 50 per cent. more power for excitation than the adjoining plant with salient poles. He asked how a compounded alternator would work in conjunction with other machines of ordinary type.

Mr. E. H. Rayner showed several oscillograph records from the Laboratoire Central, Paris, of the switching-in of a 200-kw. h.t. transformer, the irregular current waves produced being mostly below the zero line. The question of getting rid of the heat through the many layers of insulating materials in high-speed generators was a difficult one.

Mr. Gerald Stoney said they had had great doubts as to the accuracy of their results at Carville, until the author came forward with his explanation of the reason for the current being on one side of the zero line. With several machines running it was possible to get twice the normal short-circuit current if a machine were switched in out of phase.

Mr. P. W. Turner said it was known that the rotor rather than the stator was the limiting factor as regards output. The A.E.G. had adopted a special construction of rotor [see Electrical Review, September 3rd, 1909, page 379] with which a peripheral speed of four miles per minute could be used. Machines of 3,000 kw. capacity at 3,000 r.p.m. were being built on this system. He criticised the practice of specifically limiting the revolutions irrespective of peripheral speed as being unscientific, and contended that it would be better to limit the internal stress.

Mr. G. W. Partridge suggested that in view of the advance in automatic regulation, consulting engineers should allow a greater pressure drop on full load for alternators; he suggested instead of 16 per cent. to 18 per cent. that 25 per cent. to 30 per cent. might be allowed, as this would reduce short-circuit currents. In connection with a railway supply, he was proposing to use on each generator an arrangement consisting of two oil switches in series, one having an instantaneous relay and shunt resistance, and the other a time relay. The machine would be synchronised through the resistance, and he thought it would certainly limit any short-circuit current. He also considered that the instantaneous relay would at any rate act promptly enough to limit a good deal of the current.

Mr. J. T. Irwin said the author's calculation as to the forces acting on the coils neglected the effect of stray fields, and this represented additional stresses to those mentioned by the author. The armature current could be divided into both direct and alternating, so far as the effect of the stray field was concerned, and it seemed probable that the greatest damage was done by forces due to the direct current, which forces reversed each time a coil passed from pole to pole.

Mr. Miles Walker, in his reply, said the last speaker had drawn attention to a point which one might possibly overlook. He (the speaker) had short circuited the 5,500 kw. machine at pressures up to 7,000 volts, and got enormous currents. The machine was provided with old-fashioned windings, and designed for good regulation, and it would have been dangerous to go further, but on many modern machines the short-circuiting was carried out at full pressure owing to the requirements of consulting engineers. He thought that as there were more ampere-wires grouped together in the two-pole winding this gave greater stress than in the four-pole with its smaller groups. The forces were so great that one must have fairly flexible insulation as well as strong clamps, owing to the movement of the conductors under the latter. It was possible under certain conditions to get enormous forces, tending to stop the magnets and shear the coupling bolts, at the same moment that the forces on the windings were comparatively small. It was also just possible that windings would stand one short circuit, but not another. He considered, from experience, that the number of clamps provided in the Westinghouse machine was justified. The direction of coil movement depended on current conditions, and coils would not necessarily move inwards. It was possible to get effective ventilation with a cylindrical field without adding fans, but it was a good thing to have a fan to blow air on to the end windings. He believed that the Greenwich machine mentioned as having excessive excitation had better regulation than the neighbouring machines, and the small percentage of extra excitating current was, he thought, justifiable. In Glasgow a 4,000-kw. compensated alternator was running quite well in parallel with ordinary machines; the compensated machine took rather more than its share of the wattless load, and helped the regulation of the other machines. The A.E.G. rotor design enabled one to construct machines of very large output at high speeds. He doubted whether in the switch arrangement described by Mr. Partridge the shunt coil would be switched in sufficiently quickly to save the machine.

Rating and Testing of Motors for Intermittent Working.

By Dr. R. Pohl, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Sheffield, March 16th,* 1910.)

The author deals with motors used for cranes, lifts, &c., remarking that the testing practice at present prevailing is very unsatisfactory. As it is impossible to reproduce the working conditions in such cases, the motors are usually subjected to a time run of half an hour or so; but the result is an inadequate guide for the purchaser, who may obtain a motor either unnecessarily large or too small for the work, and the manufacturer is tempted to adopt designs calculated to improve the performance under test, though not necessarily under working conditions. He proposes to abandon short-time tests completely, substituting other methods of testing.

First, the author shows that the load factor, as usually defined (time of running ÷ time of running and rest combined) is misleading, and he gives instead the ratio of the (virtual current)^2 to the (full-load current)^2 as the true load factor, virtual current being defined as the root-mean-square value of the load curve in amperes. He then shows by an analysis of the conditions, that whilst the final temperature rise of an intermittently running motor with given loss depends mainly upon the cooling surface of the motor, the temperature rise after a short full-load run depends upon its heat-storing properties—that is, upon its weight; and these two properties are practically independent. Hence, the short-time run as a test is in principle unsuited for intermittently running machines.

It may be argued that a definite connection between the test result and the behaviour of the motor under working conditions is easily established; but the author points out that this is dependent entirely upon a knowledge of the "time constant" of the machine, which varies between such wide limits, even in a series of similar machines, that it is impossible to assign to it a value for any given machine without experimental determination of its magnitude. A motor intended for, say, quarter-load factor may have a temperature rise under working conditions anywhere between half and twice that found after a full-load run extending over half an hour.

The designer naturally endeavours to increase the heat-storing capacity of the motor to enable it to give a larger output during the half-hour test without undue temperature rise; this may be done by using cast-iron instead of steel for the frame, and increasing the weight of end plates, &c., thus adding some 25 per cent. to the rating. But these devices do not increase the capacity of the machine under working conditions, and can only be considered as illegitimate methods, made possible by the unfortunate practice of short-time tests. The influence of the testing practice on the rating is also shown by the lists of manufacturers, in which the same output is shown for crane motors, whether they be totally enclosed or ventilated. In practice the latter would give the larger output, but as the temperature rise in half an hour depends almost entirely on the weight and not on the cooling properties, the difference is not revealed during the test.

In order to remedy the drawbacks described, the author, after reviewing previous suggestions, puts forward alternative propositions. The first is as follows:—

The temperature rise of machines for intermittent working shall be found by subjecting them to a prolonged test consisting of successive periods of running and of rest. The running time to be 10 minutes, the standing time adjusted in accordance with the specified load factor; the duration of the test to be sufficient for the mean temperature to attain a practically constant value. The last run to be of 5 minutes' duration, immediately after which the temperature is to be measured.

A crane test with extended periods as here suggested can be carried out without great difficulty, and it meets all the requirements, but there is some disinclination on the part of the manufacturers to adopt as a standard test one requiring frequent starting and stopping, and the author, therefore, suggests replacing the curve of irregular and intermittent load by one of constant and continuous load, adjusted in such a manner that the loss becomes practically equal to the mean loss under working conditions. This object will be attained nearly enough for practical purposes, if the motor is run continuously with its pressure and current reduced in proportion to the square root of the load factor, f, *i.e.*—

$$\text{Test voltage...} = \sqrt{f} \times \text{normal voltage.}$$

$$\text{Test amperage} = \sqrt{f} \times \text{normal amperage.}$$

For the load factors ½, ⅓, ¼ and ⅛ the continuous test is to be carried out with 0·71, 0·57, 0·50 and 0·45 respectively of the normal current and pressure. It is obvious that first of all the copper losses throughout the motor will be exactly f times the copper losses at full load, as desired, and this applies both to the armature and field, whether the motor be shunt or series wound.

The iron losses in the armature are also reduced approximately in the desired proportion on account of both the flux and the speed being smaller than the normal. The friction losses are the only ones which are reduced appreciably less than in the desired ratio.

Taking the sum of all the losses, they are very little higher than $w \times f$, the product of the full load loss and the load factor. This is not a serious objection; in fact, it is desirable that it should be so, for the mean loss in running is actually somewhat greater than $w \times f$, and the continuous test as above suggested corresponds with great accuracy to average working conditions so far as the losses in all parts of the motor are concerned.

This being the case, it will be applicable to all stationary machines, such as transformers, and also sufficiently accurate for totally enclosed motors for intermittent working. The curves (fig. 1) representing the test results of a 40-h.p. motor, support this contention.

A serious objection seems to stand in the way of the employment of a continuous test for all ventilated motors. The temperature of these machines being dependent not only on their losses, but to a large extent on the effectiveness of their ventilation, it will be argued that, in spite of the equality in losses, the temperature rise after a continuous test must be lower than it will be under working conditions, when the motor is standing for a considerable portion of its working period. It must be remembered that nearly all crane motors are slow-speed machines. It will also be observed that the ventilation during the continuous test, according to the above suggestion, is reduced on account of the reduction in speed. Finally, an intermittently working motor, revolves in practice for a much greater portion of the total period than its load factor indicates. In the case of series motors, the ventilating effect is still further increased during the periods of reduced load on account of the rise in speed. The temperature rise of an intermittently

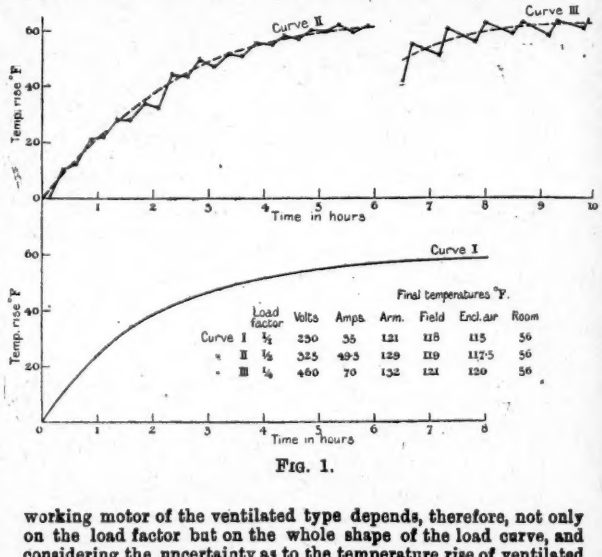

Curve II
Curve III
Temp. rise °F.
Time in hours
Curve I
Final temperatures °F.
Load factor | Volts | Amps. | Arm. | Field | Encl. air | Room
Curve I ½ | 230 | 55 | 121 | 118 | 115 | 56
II ⅓ | 325 | 49·5 | 129 | 119 | 117·5 | 56
III ¼ | 460 | 70 | 132 | 121 | 120 | 56

Fig. 1.

working motor of the ventilated type depends, therefore, not only on the load factor but on the whole shape of the load curve, and considering the uncertainty as to the temperature rise of ventilated motors due to the large variety of load curves corresponding to the same load factor which are found in practice, the author concludes that the continuous test is applicable to ventilated machines as well as to totally enclosed ones.

While it may not give exact information on the temperature rise under working conditions in every instance, it meets the fundamental principle and all reasonable requirements with which a method of testing the large class of intermittently working machines should comply.

In the case of shunt-wound crane motors, we have to distinguish between the load factor of the armature and that of the field. It will be found in most cases that they do not differ much from each other, and that the test as above described is directly applicable; otherwise the following modification of the continuous test might be specified:—

$$\text{Test voltage...} = \sqrt{f_{\text{field}}} \times \text{normal voltage.}$$

$$\text{Test amperage} = \sqrt{f_{\text{arm}}} \times \text{normal amperage.}$$

The continuous test is also applicable to all alternating-current machines, where necessary, with slight modifications.

Electric Welding.

In a paper by Mr. A. Scott Younger, B.Sc., read before the Institution of Engineers and Shipbuilders in Scotland, on February 22nd, an interesting account was given of the remarkable successes attained by Continental engineers in the repair of steamships with electric and autogenous welding. The author commented upon the slowness of British engineers to adopt these systems, their tendency being rather to condemn damaged parts outright, involving very costly renewals, whereas on the Continent the damage would be repaired in position at trifling cost, and with excellent results.

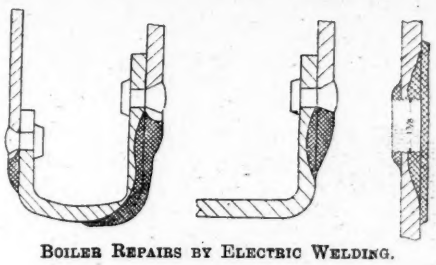
At Gothenburg the author inspected the system invented by Mr. O. Kjellberg, which had been adopted by three welding companies in different parts of Sweden. This was an adaptation of the well-known arc system of welding. The apparatus was installed on an old barge, which could be towed alongside ships requiring repairs, and comprised a De Laval turbo-dynamo working at 50-120 volts, a steam-driven air compressor for driving pneumatic tools, a workshop, &c. The process was carried out with a steel rod as the positive electrode, coated with a substance of secret composition which appeared to be of the nature of a flux. The rod was $\frac{3}{16}$ in. in diameter, and was carried in an insulated holder connected with the supply circuit; the operator applied it with his left hand, his right hand being free to use a hammer. The negative cable was connected to the work. In welding, the rod was touched against the work and withdrawn a suitable distance, striking an arc; this heated the end of the rod and the work to welding temperature, and

on pressing the rod against the work, a drop of metal adhered to the latter, which was then well hammered. This process was repeated until the weld was completed.

Tests were carried out on a number of samples, and were found to show a tensile strength nearly equal to the original value, but a reduced elongation, which was subsequently traced to the use of inferior material.

A further series of tests was afterwards made, with satisfactory results, tensile strengths of 20 to 27 tons being obtained, and elongations from 14 to 29 per cent. in 8 in., according to the nature of the samples.

Leaky seams in boilers could be caulked by welding down the edge of the plate at the rate of 11 in. in 2½ minutes. Butt-welded joints between plates, made by chamfering the edges and filling up the right-angled groove thus made, could be welded at the rate of 10 ft. per hour, the plates being ⅜ in. thick; the power required



Boiler Repairs by Electric Welding.

was 13·5 kw.—150 amperes at 90 volts. A great many illustrations of actual repairs to boilers, crankshafts, rudders, stern posts, &c., were given in the paper, almost any kind of defect apparently being readily dealt with on this system. Leaky seams could be made tight, thin parts strengthened, cracks made good, manholes restored, leaking rivets and pitted holes, &c., filled up, and generally the life of a boiler indefinitely prolonged, at small cost. Some specimens are illustrated herewith. The author considered that work so done would satisfy the tests of the Registry Societies of this country, and that there was ample scope for the introduction of the process.

The second part of the paper related to autogenous welding with the oxy-acetylene blow-pipe, universally employed in French engineering workshops. In this process the heating was not nearly so localised as with the electric system, which concentrated the heat at a point. Remarkable results were, however, obtained with this system; but the author regarded those obtained from electric welding as the more favourable.

Physical Society of London.

At the meeting held March 11th, 1910, Dr. W. H. Eccles read a paper entitled "On Coherers." A method of investigating detectors has been developed with special reference to the relations between the energy given to the detector in the form of electrical vibrations and the energy delivered by the detector, as direct current, to the circuit of the indicating instrument. The stream of energy supplied to the detector was always of the same order as that usual in telegraphy. The detector under examination was placed in a circuit containing suitable inductance and capacity, which was secondary to a primary circuit. The primary could be set into electrical vibration by breaking a known current in it. The coupling was very small, so that when a current of a few milliamperes was broken in the primary, the energy delivered to the detector was of the order one-thousandth of an erg, and the electromotive force at the coherer terminals was of the order one-tenth of a volt The response of the detector was measured by comparing the sound in its telephone with the sound produced in the same telephone by interrupting a measurable direct current. A special switch key enabled the comparison to be made quickly. The power delivered to the detector and to the telephone was determined by extrapolation from measurements on stronger currents with the thermo-galvanometer.

The results of experiments on coherers made of oxidised iron wire dipping into mercury, and on coherers made of a clean iron point touching an oxidised iron plate, were exhibited as curves, showing that, in a self-restoring coherer the current increases more and more rapidly as the E.M.F. is raised, till, in general, a point of inflection is reached, and then the current increases more slowly. If w represents the power in watts delivered to the coherer, and w the power passed to the telephone circuit, then $w = m\,(w - a)$, where m and a have values settled by the magnitude of the current through the detector. The quantity m for a good low resistance iron-mercury coherer has been found to be as high as 0·06; while a is usually near $1{\cdot}0 \times 10^{-8}$ watt. These curves show that these coherers are not "voltage-operated" detectors, but "integrating" detectors.

The author put forward the hypothesis that the properties of an oxide coherer might arise solely from the temperature variations caused in the minute mass of oxide at the contact by the electrical oscillations and by the applied E.M.F., and showed that most of the phenomena recorded could in this way be accounted for as perfectly as the present state of the measurements permitted.

A paper entitled "Earth-air Electric Currents" was read by Mr. G. C. Simpson, describing a method for automatically recording the electrical current which passes from earth into the air during periods of fine weather. A large plate was placed in the open as near to the ground as was consistent with efficient insulation, and was connected to an insulated vessel from which water issued through an orifice surrounded by an earth-connected cylinder. The water as it dropped from the insulated vessel carried away, by the well-known "collector" action, all the charge which the exposed plate received, and the latter remained at zero potential. The charged water drops were collected in a vessel connected to a self-registering electrometer, which was earth-connected for an instant at the end of every two minutes.

Dr. Russell said that C. T. R. Wilson had found that the mean earth leakage current in his experiments was about $2\,2 \times 10^{-16}$ amperes per sq. centimetre. It was, therefore, exceedingly small. Linke had shown from the results obtained in balloon ascents that the atmospheric potential gradient diminished regularly up to a height of 6,000 metres, and probably much higher. Assuming that air had "conductivity," this showed that the conductivity increased with height. It seemed reasonable to suppose that at great altitudes, notwithstanding the intense cold, the highly rarefied air was practically a conductor. The earth leakage currents carried charges to these conducting layers, and these charges were continually being returned to the earth by the storms always taking place somewhere or other in the world. The energy expended by the currents was probably due originally to the sun's heat vapourising and raising water to heights in the air.

Electricity in Agriculture.—A correspondent of the *Daily News* has interviewed Mr. Lionel Lodge regarding the progress made in the application of Sir Oliver Lodge's system to agriculture, and learns that the effect of electrification is to produce an increase of 30 per cent. in the yield on average soil. Several installations have been carried out in this country and in Germany with successful results. The cost of the installation for 30 acres of strawberries, of which 24 acres are bearing fruit, is roughly as follows:—

First cost of installation erected	£300
Depreciation at 15 per cent.	45
Fuel costs for 1-H.P. oil engine running 12 hours per day, 180 days at 1d. per hour ...	9
Labour, two hours per day at 6d. per hour ...	9
Total annual upkeep	£63

The revenue side of the account is as follows:—Take average return at £36 per acre; 33⅓ per cent. increase equals £12 per acre. Deduct 33⅓ per cent. as cost of picking and marketing the extra crop, and the balance, £8 per acre, is due to the electricity, amounting to £192. Deduct cost of upkeep, £63, and the net result is—£129 profit on an outlay of £300.

Proposed Belgian Tariff Revision.—The Belgian Government has prepared a Bill for the revision of the Customs tariff, and proposes to utilise the measure, if adopted by Parliament, for the purpose of concluding a favourable treaty of commerce with France in connection with the latter's new tariff. If passed, the Belgian tariff, which will also apply to all other countries except where new treaties are negotiated, will come into force immediately on receiving the sanction of the Legislature. The Bill is of some interest to the electrical industry, particularly that of France and Germany, as an increased duty on electrical machinery and apparatus is in contemplation. It is stated that the question has engaged the attention of the Belgian Government for some time past, and a Commission was appointed to consider the subject. The representatives of branches of industry other than electrical engineering were opposed to increased duties, and the Association of Ironmasters pointed out that the needs of trades employing 300,000 workers deserved more consideration than those of the electrical industry, with its 6,000 workers. Electrical machinery has hitherto been included under the existing Belgian tariff as mechanical machinery, and has been subject to a duty of 16s. per ton for machines of cast-iron, £1 12s. per ton for those in which iron and steel predominate, and £4 16s. per ton for those in which copper is the principal metal. The new tariff proposes to abolish the rate of 16s. per ton and to place all iron and steel on the £1 12s. basis, leaving copper articles unchanged. As showing how the higher duty would affect imports, it is mentioned that, whilst France supplies Belgium with arc-lamp carbons, glow lamps, &c., to an inconsiderable extent, Germany supplies electrical machinery and apparatus to Belgium to the value of £400,000 per annum, apart from cables of £220,000, which are specially protected from any increase by the Belgo-German Treaty of Commerce of 1904. The Brussels correspondent of a Cologne newspaper states that, on the whole, only two large companies are concerned with the new tariff, namely, the Charleroi Construction (Empain) Works and the International Electricity (Pieper) Co., of Liége. The former has a share capital of £198,000, and earned net profits of £41,000 in the past financial year, whilst the latter has a capital of £251,000 and realised net profits of £17,500 in the year, although this amount had to be applied to the purpose of depreciation. It is therefore submitted that the industry does not need additional protection, and it is added that German firms already have a difficult task to compete with the Belgians, as, for instance, in the case of a sub-station contract for Ostend last year, when a Belgian tender was much lower than the three German offers which were made.

THE GOTT–RAYMOND-BARKER CALIBRATED CURVE-SHEET FOR JONA GRAPHS.

NOTE FOR SUBMARINE CABLE STAFFS.

BY EDWARD RAYMOND-BARKER.

WHEN Mr. John Gott makes a suggestion it is certain to be a good one, and essentially practical.

The suggestion of which there is now question was made in connection with the writer's adoption, diffusion and general development of Mr. E. Jona's interesting application of graphic methods to the electrical localisation of cable breaks.

In order to simplify, for cable station time-saving purposes, the Jona graph routine, let a small sheet of millimetre squared paper be prepared. Let this sheet be calibrated with horizontal lines severally inscribed at certain distances from a point representing unity.

Let the distances of the calibration lines from a given point be proportional to Jona's neat expression for obtaining a compact form of curve—namely, the reciprocal of the square-root of the current passed through a cable-break; that is— $\frac{1}{\sqrt{MA}}$.

It is taken for granted that any important localisation test would be made with low-resistance battery cells *in perfect condition*. This presupposition enables one to simplify the routine still further by arranging for the points of calibration to be in terms of *battery cells*, say, 48, 24, 12 and six cells Leclanché. Here we observe the order in which bridge-readings to cable-break would be made, for measurements with the higher currents ought always to precede those with the lower, thus conducing to greater steadiness in results.

A sheet thus arranged enables the operator to ignore the noting of milliamperes and the reciprocals of their square-roots, as long as he has sufficient resistance in the cable circuit to limit his testing currents to Kennelly's 25 milliamperes.

The operator notes merely a series of bridge-readings to

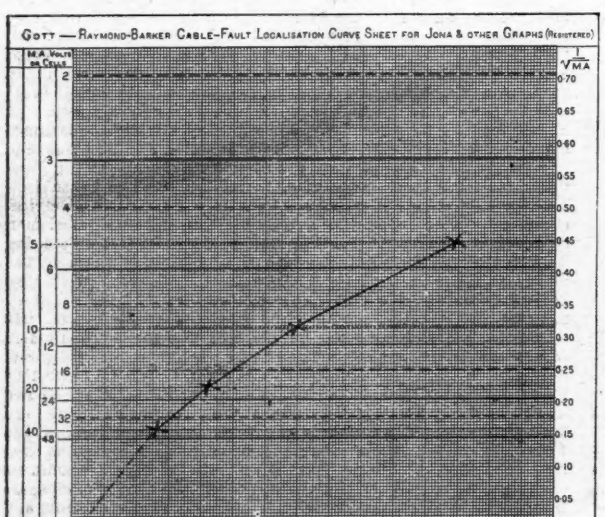


FIG. 1.

scale zero, or to false zero according to the requirements of the case, using, say, 48, 24, 12 and 6 cells. He makes corresponding plottings on the curve sheet at the points where the several battery-power calibration lines (*ordinates*) intersect the vertical lines (*abscissæ*) rising from the points—on the horizontal line of resistance—representing the several bridge-readings. The said points of intersection indicate the direction of the Jona curve.

Fig. 1 shows on a reduced scale how the writer has put Mr. Gott's suggestion into concrete form. Limited as to space, the millimetre squared paper has an area of 150 mm. × 150 mm.

There are *three* easily distinguishable sets of battery-power calibration lines which, on the actual sheets, are coloured red.

These three sets severally belong to the three different

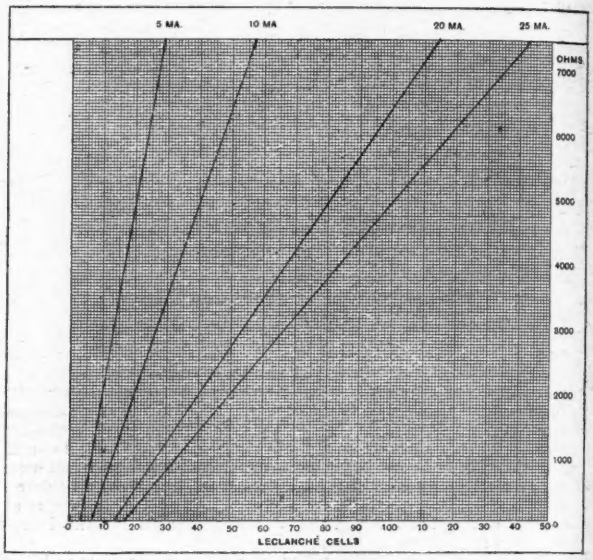


FIG. 2.

arrangements of battery cells shown in the triple column to the left of the sheet.

Thus with this sheet, the operator may use any one of the following three different groupings of battery cells, which may happen to accord with station or cable-house normal practice :—

48, 24, 12, 6, 3 cells,
or 40, 20, 10, 5 „
or 32, 16, 8, 4, 2 „

In fact, in cases where it is advisable to obtain for a curve a large number of plottings these last-mentioned may easily be made in regular sequence from all the tabulated battery powers—viz., 48, 40, 32 . . . right down to two cells.

The horizontal line of resistance from which spring the abscissæ may be divided off to any convenient scale—say, 2 ohms to the millimetre; *i.e.*, 50 mm. = 100 ohms. If called for, a more restricted scale may be used, or if greater sensitiveness be required, two curve sheets may be pasted together.

On the reduced-scale curve sheet shown in fig. 1, the Jona graph of an actual cable break localisation is given. In this example the following electrical values obtain. Resistance inserted in series with the cable to bring the current from a maximum battery of 40 cells within the limit of about 25 milliamperes was 992 ohms.

Deducting this inserted resistance from each bridge reading to scale zero :—

Test with 40 cells gave 53 ohms.
„ 20 „ 84 „
„ 10 „ 139 „
„ 5 „ 238 „

The break was 2 ohms from ship's cut-in.

When tests are made over considerable lengths of laid cable, a strong *natural* or *telluric* current may be found to be affecting the normal proportionality of the several battery currents. Any such irregularity would show itself on a milliammeter between bridge and cable. It will then be beneficial to utilise Mr. G. B. Winkfield's device, described

in Kempe, Seventh Edition, page 291, and already referred to by the writer in a previous article. In this manner *false zero* and *scale zero* might be made to coincide.

To make the new curve-sheet adaptable for use with the Jona routine, the right side is marked off in terms of

$$\frac{1}{\sqrt{MA}}$$ values, from *zero* to 0·75.

For general station or ship use, 100 sheets are made up into a book.* A row of perforations allows of any sheet on which a test-graph has been recorded being torn out, and sent by post.

In fig. 2 straight-line "curves" are given which, in connection with the proper use of the new curve-sheet, will be found convenient for indicating at a glance (in the absence of a milliammeter), either of the two following items of information :—

(*a*) Given the number of battery cells used in a Wheatstone bridge test to a broken end, what will be resistance necessary in the cable circuit, to adjust the current to 5, 10, 20, or the maximum of 25 milliamperes ?

(*b*) Given a known approximate resistance in circuit, what number of Leclanché cells will be necessary to adjust the current to 5, 10, 20, or the maximum of 25 milliamperes ?

The foregoing conditions apply to tests with low-resistance cells and Wheatstone bridge ratio arms of 1,000 : 1,000 ohms.

In fig. 2 the relative lines of resistance (*ordinates*), and the corresponding lines indicating battery power (*abscissæ*)

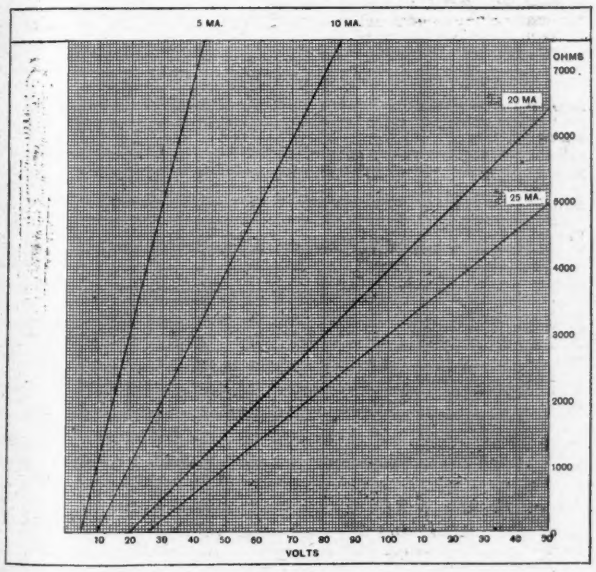


Fig. 3.

intersect on the straight-line "curve" for a given current. A pair of dividers is often found handy for noting values from these curves.

Fig. 3 is similar to fig. 2, excepting that the straight-line "curves" for 5, 10, 20 and 25 milliamperes are in terms of resistance and *volts* instead of resistance and Leclanché cells.

Should the operator desire to enlarge the scope of these two charts, he has but to extend the straight-line curves.

Figs. 2 and 3 have been reduced from originals drawn on millimetre squared paper.

It is obvious that a ruler, or straight-edge, may be calibrated like the triple column to the left of the new curve sheet or with the same principle still further developed. This, indeed, has already been done. For obvious reasons, however, the providing of books of easily detachable calibrated sheets of millimetre paper offers advantages which will commend themselves to many.

* Published by W. H. Harling, 47, Finsbury Pavement, London, E.C.

ELECTRIC SIGNALLING AT BIRMINGHAM (SNOW HILL) STATION.

The Great Western Railway Co., who are carrying out a scheme of structural alterations at Snow Hill Station, have installed an electric signalling installation, although owing to the alterations mentioned above, it is only possible to utilise the signalling on the north side.

The locking frame, in the signal box, contains 224 levers, and has a total length of 37 ft. 6 in. The small levers are the only working parts outside the frame, the remainder of the mechanism being enclosed in panelled sheet-iron casing; the levers are connected inside by rodding to switches, mechanical locking and check-locks. In the frame the locking is of the form known as "tappet" locking; if one lever has to lock another, when it is pulled, a horizontal bar is shifted laterally, causing a wedge bolt to enter a recess in the conflicting lever rod and so lock it. Coupled to the same rod that operates its necessary locking is the switch for joining up the circuit to the points or signal. Check-locks are also provided in the frame. These act on the rod referred to above, their function being to prevent the signalman from completing the movement of his lever until the points or signal have reached their new position.

The machines for operating the points are placed where possible adjacent to the points, and consist of a motor (with double field windings for reversing) and suitable gearing which terminates on the outside of the case in the form of a crank. For trailing points this crank is directly coupled on the point rod, but with facing points, where the points must be bolted and protected with a locking bar, the machines are provided with friction clutches, so that should the points become jammed owing to some foreign substance getting between them and the stock rail, the motor will continue to revolve until it cuts itself out. In addition to the point operating machine, there is at each point an electrical detector which consists of a case carrying a varying number of contacts on either side, according to the requirements. These contacts are only made when the points are completely over, and in the case of facing points when the locking bolt is re-inserted in its correct position. One pair of these contacts joins up the circuit of the check-lock magnet, and the others are in the circuit of the signals, so that should they not be correctly established, the signalman would not be able to pull a signal "off," or if it were already "off" it would immediately go to danger should one of these contacts become opened.

A noteworthy feature also is the fitting up of route indicators showing the number of the platform or road the train is to arrive at, underneath the signal arm. These can be easily seen by day, and are electrically illuminated by night. The electrical supply for working the installation is at a pressure of 140 volts, and is obtained from accumulators of 300 ampere-hours' capacity, which are charged by means of motor-generators. The motor-generators are driven by alternating current at 110 volts, transformed at the G.W.R. station from the Corporation supply. Provision is made against any accidental breakdown by the duplication of the machinery, and, furthermore, by means of the switchboard at the generating station any combination can be made. Messrs. Siemens Bros. & Co., Ltd., are responsible for the installation.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NICARAGUA.—The exact net and gross weights in kg. should be marked on each package and specified on invoices, bills of lading and certificates of origin. The net weight of each class of goods included in one consignment should be stated, and the country of origin should be declared on all documents. A mark and separate number should be placed on each package, and the separate net weight of each class of goods if more than one class is contained in one package. Invoices certified by a Nicaraguan Consul should be produced in Spanish. Six copies are required. The following fees are payable to the Consul for certification :—

Invoice of value not exceeding	£20	... 10s.
" " "	£40	... 12s.
" " "	£100	... 20s.
" " "	£200	... 40s.
" " above	£200	... ½ per cent.

The invoices must show in column form the number of packages, the class of each, the number of each, the mark of each, the gross weight of each in kg., the total weight, the number, kind and quantity of the goods, the country of origin, and the value in pounds sterling. The invoice must also show on the back the number of folios, the number of packages, the total gross weight of each, the total value of the articles, such value to include freight, insurance, commission, &c., the consignor, the address of consignor, the port of embarkation, the class, nationality and number of the

vessel, the captain, the voyage, the port of entrance, the port to which consigned, the name of the consignee and his address, the Consular fees paid, &c.

A declaration must also be made and signed. The following duties are payable:—

	Per kg.
Machine belting of all kinds imported with the machines	Free.
Machine belting of leather or rubber	·38 pesos.
" " " hair	·08 "
Telegraph and telephone posts, ties and uprights	Free.
Copper, brass, &c., in ingots or grains	·15 pesos.
" " " " bars	·15 "
" " " " plates or sheets	·11 "
" " " " wire covered with silk or wool	·38 "
" " " " " " other material	·90 "
" " " " " insulated for electric light	Free.
Bells of copper, brass, &c.	·38 pesos.
Lamps of brass, neither gilt nor silvered	·75 "
" " " gilt, or silvered or nickelled	1·50 "
Iron or steel wire, galvanised or not, up to 3 mm. diameter	·11 "
Iron and steel wire of all kinds exceeding 3 mm. diameter	Free.
Iron posts and cross-pieces for electric cables	Free.
Iron or steel wire covered with cotton, linen, wool, silk or paper	·15 pesos.
Iron or steel bells	·15 "
Articles of glazed earthenware	·04 "
Pottery of earthenware or terra-cotta	·06 "
Insulators	·11 "
Chandeliers, candelabra and parts thereof	·30 "
Pipes, tubes and conducts of earthenware	·01 "
Globes, shades, &c., for lamps	·19 pesos.
Lamps of crystal, glass or porcelain	·23 "
Telegraph and telephone apparatus	Prohibited.
Electric batteries for industrial purposes	Free.
Pumps and turbines	Free.
Electric machines for medical practitioners	·38 pesos.
Bulbs and lamps for incandescent or arc electric light	Free.
Instruments, hydraulic, physical, &c., unenumerated	Free.
Steam engines	Free.
Lightning conductors	Free.
Machines of all kinds unenumerated	Free.
Miners' lamps	Free.

Peso = 4s. Kg. = 2·204 lb.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,019. "Improvements in electric appliances." A. E. Tanner and E. A. Claremont. (Date applied for under Rule 13, April 8th, 1909. An invention comprised in Application No. 27,858, dated April 8th, 1909.) March 21st. (Complete.)

7,089. "Mast for use in wireless telegraphic apparatus and for other purposes." A. F. Juillac. (Date applied for under Sec. 91 of the Act, March 27th, 1909, being date of application in France.) March 21st. (Complete.)

7,093. "Improvements in automatic telephone exchanges." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) March 21st. (Complete.)

7,096. "Improvements in magnetos for ignition purposes of internal combustion engines." J. Barker. March 21st.

7,141. "Means for and method of limiting the flow of current on a short circuit." A. M. Taylor. March 22nd.

7,154. "Improvements in electrical signalling apparatus." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) March 22nd. (Complete.)

7,184. "Apparatus for producing high frequency oscillating currents." F. Jacoviello. March 22nd. (Complete.)

7,201. "Process for manufacturing metal filaments for electric incandescent lamps." A. Bourdos. March 22nd.

7,211. "Improvements relating to telephone systems." British Thomson Houston Co., Ltd. (General Electric Co., United States.) March 22nd. (Complete.)

7,212. "Improvements in and relating to insulators for high-tension and transmission systems." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 22nd.

7,214. "Improved arc light candle." A. Fish. March 23rd.

7,224. "Improvements in apparatus for the electro-deposition of metals." T. A. Smith and T. Deakin. March 23rd.

7,225. "Improved apparatus for the electro-deposition of metals." T. A. Smith and T. Deakin. March 23rd.

7,226. "Improvements in electroplating barrel apparatus." T. A. Smith and T. Deakin. March 23rd.

7,248. "Improvements in electric ignition apparatus." R. F. Hall. March 23rd.

7,261. "Improvement in synchronisers for motor engines of four, six and eight cylinders." W. L. Jarvis. March 23rd.

7,266. "Improvements in or relating to single-phase commutator motors." Siemens Bros. Dynamo Works, Ltd., and F. Lydall. (Siemens Schuckertwerke G.m.b.H., Germany.) (Application for Patent of Addition to No. 2,808/08.) March 23rd. (Complete.)

7,292. "Improvements in electric frequency converters." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) March 23rd. (Complete.)

7,309. "Improvements in and relating to controllers for alternating-current motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 23rd. (Complete.)

7,318. "Improvements in starting switches for polyphase alternating-current induction motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 23rd. (Complete.)

7,322. "Improvements in short-circuit detectors." F. C. Reineking. March 3rd. (Complete.)

7,332. "Improvements relating to electric contact devices." W. G. Housekeeper. (Date applied for under Sec. 91 of the Act, March 31st, 1909, being date of application in United States; application for Patent of Addition to No. 7,331/10. March 23rd. (Complete.)

7,336. "Improvements in or relating to electrical connecting devices." J. M. Sladen. March 23rd.

7,373. "Improvements in and relating to incandescent electric lamps." S. Horvath. March 24th.

7,414. "Means for and method of limiting the flow of current on a short circuit." A. M. Taylor. March 24th.

7,428. "Improvements in or relating to circuit controlling devices particularly adapted for use with electrically-controlled pressure regulating devices." Adams Manufacturing Co. (Cutler-Hammer Manufacturing Co., United States.) March 24th. (Complete.)

7,437. "Device for effecting interchangeable advertisements by means of rollers to be used in electric flash or other lamps." P. V. Howship. March 24th.

7,460. "Improvements relating to phototelegraphy." T. T. Baker. March 24th.

7,463. "Improvements in a system for preventing shaft voltages or bearing currents in electric machines." Felten & Guilleaume Lahmeyerwerke Act. Ges. (Date applied for under Sec. 91 of the Act, April 27th, 1909, being date of application in Germany.) March 24th. (Complete.)

7,465. "Improvements in electromagnetically controlled electric switches." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) March 24th. (Complete.)

7,468, 7,469, 7,470 and 7,471. "Improvements in and connected with apparatus for the electric lighting, heating, cooling and ventilating of railway carriages and other vehicles." J. Stone & Co., Ltd., and A. H. Darker. (Date applied for under Rule 13, March 27th, 1909. An invention comprised in application No. 7,425, dated March 27th, 1909.) March 24th.

7,488. "Improvements relating to dynamo-electric machines." Crompton and Co., Ltd., J. Colquhoun Macfarlane and H. Burge. March 26th.

7,557. "Mechanism for converting the rotary motion of an electric or other motor into a reciprocatory or intermittent reciprocatory motion such as is required by a pickling machine for pickling steel sheets." W. S. Williams. March 26th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Electric Lighting or Heating Systems specially applicable to Train Lighting. J. P. Crouch and J. Etchells. 25,844. November 30th.

Telegraphic Recording Apparatus. T. M. C. Bingham. 27,862. December 22nd. (Post-dated July 22nd, 1909.)

1909.

Arrangement for Generating a Synchronous Alternating Current of Limited or Defined Strength. R. Moser. 5,003. March 1st.

Means for Rectifying Electric Currents. T. J. Murphy. 5,081. March 2nd.

Secret Telephone Transmitters. L. Heyworth. 5,114. March 2nd.

Electrical Regenerative Control Apparatus and Systems. Crompton & Co. and J. C. Macfarlane and H. Burge. 5,168. March 3rd.

Automatic Switch for use with Electric Transformers. R. Addison. 5,427. March 6th.

Electric Safety Mechanism for the Doors and Gates of Electric Lifts and Hoists. J. C. Etchells. 6,495. March 18th. (Post-dated August 18th, 1909.)

Electric Arc Lamps. H. J. J. Jaburg. 7,471. March 29th. (Date applied for under International Convention, March 28th, 1908.)

Self-Regulating Alternating-Current Additional Machine or Booster. R. Morse. 8,315. April 6th. (Date applied for under International Convention, July 11th, 1908.)

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